

was also excellent information exchanged on seed propagation, grafting, and details on the propagation of specific cultivars of evergreens, trees, and shrubs. The willingness to share the knowledge about the art, practice, and science of propagation made it possible for everyone to leave the meetings with new ideas that could be used in the nursery or the laboratory. This open exchange of information was at the heart of IPPS' tremendous success in the early days as it continues to be pivotal in the present!

Breeding New Selections of Repeat Blooming Daylilies[®]

Darrel Apps

Woodside Nursery, 327 Beebe Run Road, Bridgeton, New Jersey 08302 U.S.A.

Arlow Stout (1876-1957), while at the New York Botanical Garden, played a pivotal role in the development of modern daylilies. Through his various contacts (especially Albert Steward, 1897-1959, working at Nanking University in China), he was able to collect several *Hemerocallis* species and many of the existing cultivars. He used these plants for hybridizing and described them in a book entitled, *Daylilies*, published in 1934. Stout's well-documented ground work set the stage for the cultivar explosion that was to follow.

The effort was slowed by the Great Depression of the 1930s and World War II but met new enthusiasm in 1946 when the Midwest *Hemerocallis* Society was formed and hundreds of amateurs began breeding daylilies.

My first exposure to daylilies, was with the plant, *H. fulva*, 'Europa', which made its way to America with the European immigrants; Stout gave it cultivar designation 'Europa'. Its common name was the tawny daylily and it was planted under the roof eaves on the south side of my one-room country school in Wild Rose, Wisconsin. Sometime during those 8 years of elementary school, 1943-1951, (the same time the American *Hemerocallis* Society was formed) I saw this plant in bloom and admired how exotic it appeared in contrast to other flora of the area (incidentally, it never reblooms).

Much later, in the 1960s I began collecting plants, including 'Europa' and in 1969 made my first crosses. Since 1969 (for 31 years) I have grown a crop of *Hemerocallis* seedlings every year. At first I grew 500 hand-pollinated seedlings a year, later 3000 to 5000 and today as many as 18,000. In my early years of collecting daylilies I became aware that a few rebloomed and often extended the bloom season from 3 weeks to nearly 6 weeks. Unfortunately, the best rebloomers were usually yellow and gold cultivars, but there were a few notable exceptions. Two non-yellow rebloomers I grew in my garden in Lexington, KY, in the late 1960s were 'Baby Darling' (purple) and 'Chipper Cherry' (red). I began crossing them with 'Bitsy' (and evergreen reblooming yellow-flowered plant that bloomed 3 times in Kentucky) and started getting a few seedlings that rebloomed once. About that same time I made several crosses with species daylilies. Over the years I observed some rebloom in three species, *H. aurantiaca*, *H. thunbergii*, and *H. minor*. The observation of rebloom in *H. minor* is contrary to a few earlier reports.

With these experiences as a reference I established the goal to produce reblooming

daylilies. I could easily spend the rest of this presentation time on the various hypotheses and ideas that failed, on how quickly 30 years have passed and on some of my rather dismal results. However, hybridizers by their very nature are eternal optimists. There's always another idea that needs to be tried! There's always the promise of a new crop of seedlings!

Here are a few things I have learned. For a daylily cultivar to rebloom in northern areas of the United States it must have:

- the genetic makeup for rebloom
- high light intensity during the entire growing season
- adequate moisture all season long
- a high level of fertility
- a long enough growing season

Another observation is that rebloom is different in deciduous and evergreen daylilies. This area needs more research. It appears that the flower buds are formed in deciduous daylilies, like 'Stella de Oro', and 'Happy Returns' during the required vernalization period and there is as many as 3 to 4 scapes, initiated per ramet (Fig. 1). In deciduous daylilies often a sequence of flowering scapes occur in

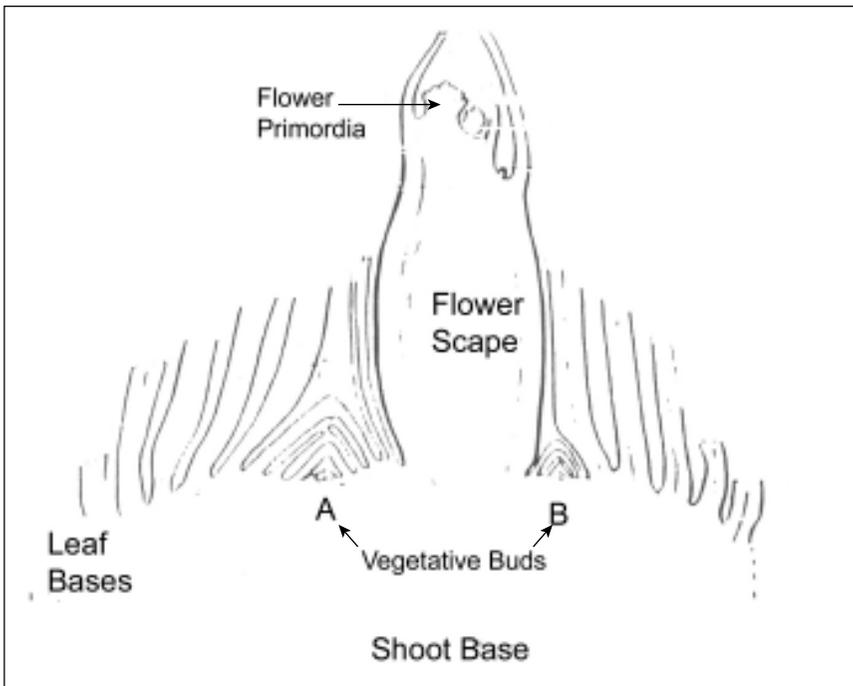


Figure 1. Cross-section of a non-reblooming daylily stem. In deciduous daylilies often a sequence of flowering scapes occur in axils of the leaves (three or four are not uncommon from one ramet). In once rebloom daylilies bud A or B will sometimes be a flower scape rather than a vegetative shoot. Evergreen daylilies rebloom because shoots A and B become mature enough to flower in one season without the need for cold winter temperatures.

axils of the leaves (three or four are not uncommon from one ramet). In once-rebloom daylilies bud A or B will sometimes be a flower scape rather than a vegetative shoot. Evergreen daylilies rebloom because shoots A and B become mature enough to flower in one season without the need for cold winter temperatures.

During the long days of the growing season these preformed flower stalks unfold in a sequence pattern. If the season is extended for a long period of time, in a greenhouse, blooming stops and does not reoccur until the plant is subjected to short days and cold temperatures. Evergreen daylilies often rebloom from the new plant formed and do not require short days and cold temperatures for flower formation. All of the above becomes much more complex when cultivars are selected from evergreens crossed with deciduous daylilies. And the complexity seems to be even more profound in tetraploid daylilies.

Now I would like to describe a long-term breeding program focused on producing deciduous rebloom daylily cultivars in colors other than yellow and gold. After many false starts I produced a few yellow daylilies that rebloomed. When I crossed them together or backcrossed them with their parents, I observed a higher percentage of daylilies with some rebloom. When I outcrossed with non-rebloomers, there was no rebloom. I made the assumption that rebloom was a recessive trait and that perhaps more than one chromosome was involved, otherwise the rebloom frequency should have been greater.

In 1975, Walter Jablonski from Merrillville, Indiana, introduced a cultivar, 'Stella de Oro', which bloomed almost continuously. In a conversation with Walter I learned he had used 'Bitsy' with several other cultivars, and that he had then crossed the F1s together. I purchased the plant and that very same year crossed it to many of my own cultivars, some with rebloom. In fact I used this cultivar for at least 5 years. Out of 8000 seedlings I was able to select one near continuous bloomer of a much lighter color and named it 'Happy Returns'. One melon-colored flower out of 'Baby Darling' had near continuous bloom but melted out by 10 A.M. each morning. Progeny from it also melted out, so after much work and a few years, I abandoned this whole line.

By this time I had also produced a red reblooming daylily 'Pardon Me' from a totally different genetic background and began to use it. I also had a wide-petalled evergreen introduction 'Sugar Cookie' that I learned rebloomed 3 to 4 times in Florida. I decided that if I was to see the recessive rebloom traits in other colors I would have to cross 'Happy Returns' onto these and then cross the offspring together. Hopefully I would get the rebloom and non-yellow daylilies in the same plant. I selected a red and a near-white out of these respective crosses. I then crossed these together and out of 50 to 60 seedlings got two rebloomers, both continuous bloomers and both starting to bloom late in the season. One was red, the other a melon; the melon had a melt-out problem so I used the red. By this time I had a reblooming yellow seedling out of 'Brocaded Gown' by 'Happy Returns', patented and named 'Fragrant Treasure', which gave a higher percentage of rebloom seedlings. When I crossed 'Fragrant Treasure' onto the red seedling all of the seedlings in the cross rebloomed but some much more than others. This has lead me to believe that there is also a gene for how much rebloom. From this group of seedlings I selected one plant which I named and patented under the name 'Rosy Returns'. I am now three generations beyond 'Rosy Returns' and have many reblooming seedlings, however only a handful are total rebloomers. Here are a few

examples of rebloomers to be introduced:

- Apricot Sparkles
- 96-12 ('Sunny Honey' × 'Opportunity')
- 96-23 ('Sue Rothbauer' × Rebloom seedling)
- 96-78 ('Janice Brown' × 'Pink Recurrence')
- 96-26 ('Royal Occasion' × 'Sue Rothbauer')
- 97-42 ('Ruffled Masterpiece' × Rebloom seedling)
- 97-554 ('Ruffled Masterpiece' × Rebloom seedling)

My efforts have now focused on colchicine-induced tetraploids with the hopes that doubling the chromosomes will also increase the total rebloom frequency. I have converted 'Rosy Returns' to the tetraploid level and have crossed it with many once-reblooming tetraploids. This year I bloomed a few seedlings from these crosses. Here are a few examples of tetraploid seedlings that rebloom at least once:

- 98-598c ('Barbara Keen Strout' × 'Royal Braid')
- 98-644 ('Strawberry Candy' × 'Barbara Keen Strout')
- 'Glacier Bay' × 'Bridgeton Bishop'
- 'Bela Lugosi' × 'Sultry Siren'
- 00-410 ('My Darling Clementine' × 'Senegal')
- 99-1487 [('Goosebumps' × 'Ruffled Dude') × 'Glacier Bay']
- 98-111 ('Untamed Glory' × 'Goosebumps')

Most of you realize there are many daylily hybridizers and that no individual hybridizer works alone. I need to express my thanks to many different individuals who have helped advanced the daylily. I continually purchase their best new plants and incorporate them into my breeding program. Unfortunately many excellent cultivars never get recognition because they are not marketed beyond the American Hemerocallis Society. I've been fortunate in having marketing assistance from Denny Blew at Centerton Nursery in Bridgeton, New Jersey. Two of our most successful marketing strategies are the trademarked names, Trophytaker™ and now the Happy Everappster™. Our plants are sold in independent garden centers up and down the East Coast and as far west as Michigan, Ohio, and Kentucky. Plans our now underway to expand these trademarks by syndication to other market areas.

I came to work three days ago and noticed on the table where these towering daylilies are sitting in full blazing sun that they were almost at the "we've got to reduce them because they've started set..." Will removing the seed pods help them to bloom a second time?

Ceroid remarked quite pleasantly: Not unless they are a repeat blooming cultivar such as 'Stella d'Oro', 'Happy Returns', 'Bitsy', 'Yellow Lollipop' or 'Pardon Me'. And Madgardener jumped in with her nickel's worth. "I have Jackson Perkin's patented "Supreme Stella d'Oro" and "Supreme Stella Ruby", Happy Returns, Butterscotch Ruffles and Crimson Pirate, all which are repeat bloomers, but BUT here's something I was TOTALLY unaware of th Focus is on the production of reblooming daylilies. It is emphasized that for a daylily cultivar to rebloom in northern areas of the United States it must have: the genetic makeup for rebloom, high light intensity during the entire growing season, adequate moisture all season long, a high level of fertility, and a long enough growing season. Do you want to read the rest of this article?

Cabbage cultivars and advanced breeding lines were evaluated in a full-bed mulch system with a population of 43,200 plants/ha during the winter seasons of 1988-89 and 1989-90. Yield and adaptability were assessed for 31 entries in 1988-89 and 30 entries in 1989-90. Highest yields in 1988-89 were produced by 'Grand Slam' with 84.2 t/ha and an average head weight of 2.2 kg. New varieties. Natural selection and selective breeding can both cause changes in animals and plants. The difference between the two is that natural selection happens naturally, but selective breeding only occurs when humans intervene. For this reason selective breeding is sometimes called artificial selection. Different varieties of plants and animals with desired characteristics can be developed by selective breeding. For example: cows that produce lots of milk. chickens that produce large eggs. wheat plants that produce lots of grain. The new varieties may be economically important. For exa