

DECEMBER, 1980
NO. 236

The American Peony Society Bulletin





A Christmas Greeting



In June, friends placed a bowl of peonies on the counter at their place of business. Coming to settle their accounts, the patrons quickly noticed the flowers. They were forced to pause and to comment. Soon it was necessary to have a small sign posted saying, "The peonies are real."

As the blooms are real in June, so is the spirit of Christmas real in December. True, a bit of searching is needed if we would know the full meaning of this season. But this seeking is made easier because of the pervasive feeling of new joy. This soon becomes a part of each one of us. Then we are the signs of its reality.

The peony has its full share of hymns to its beauty. Here is a product of a secret aim of nature. It confronts us, armed in the garments of its own distinctive appeal. There is no resisting its call of color and form and fragrance. But now its time with us is past, and what we have known in June lingers only in memory, with visions of the next growing season.

This winter holiday time has its own characteristic aura. Mankind long had expected One who would lift the long shadows of this world. Suddenly, it was to the shepherds amid their vigils in the fields that the skies were opened. The angelic choirs sang an anthem of peace and good will. They chanted of Him Who came not just from earth but from heaven as well. Now in December we proclaim anew the Christ with new light and joy and hope. We are glad, confident that what we now see is but a shadow of the things which are to be.



Harriet and Floyd Miller
Fergus Falls, Minnesota

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DEPT. OF REGISTRATION

The department was formed to properly supervise the nomenclature of the different varieties and kinds of peonies. All new varieties should be registered to avoid duplication of names.

Greta M. Kessenich, Secretary

OBJECTIVES

The Articles of Incorporation state: Section (2) That the particular objects for which the corporation is to be formed are as follows: To increase the general interest in the cultivation and use of the Peony; to improve the methods of its cultivation and methods of placing it upon the market; to increase its use as a decorative flower; to bring about a more thorough understanding between those interested in its culture; to properly supervise the nomenclature of the different varieties and kinds of peonies; to stimulate the growing and introduction of improved seedlings and crosses of such flower; and to promote any kind of the general objects herein specified by holding or causing to be held exhibitions, and awarding or causing or procuring to be awarded, prizes therefor or in any other manner.

The AMERICAN PEONY SOCIETY BULLETIN is the official Society publication. It is mailed postpaid quarterly to all members in good standing.

MEMBERSHIP

The By-Laws state: All reputable persons, professional or amateur, who are interested in the Peony, its propagation, culture, sale and development are eligible for membership. Dues are as follows:

Single Annual.....	\$ 7.50	Junior or member family.....	\$ 2.50
Single Triennial.....	20.00	Life.....	150.00
Family Annual.....	10.00	Commercial membership.....	25.00
Family Triennial.....	27.50		

Family membership, any two related members in same household.....One Bulletin
 Junior membership, any age through completion of high school.....Separate Bulletin

For those who wish to further support the Society, the following special memberships are available.

Contributing.....	\$25.00	Supporting.....	\$100.00
Sustaining.....	50.00	Patron.....	250.00




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FROM YOUR PRESIDENT

On behalf of the officers and directors of the Society, I express the best of holiday greetings.

Your peony work has been completed, and now we wait for Mother Nature to put a white blanket of snow over it.

These winter days are an opportune time to make plans to attend the 1981 peony exhibition at Kingwood Center, Mansfield, Ohio, on June 12, 13, and 14. Kingwood Center consists of 47 acres in which numerous gardens are on display with thousands of various plants for you to enjoy. It maintains a very large collection of peonies. Together with this planting and the American Peony Society exhibition in the display hall, you will see the latest in the herbaceous and a large display of the exotic tree peony with their vibrant colors.

The personnel of Kingwood Center always extend a warm greeting of welcome. We hope you will be a part of this convention and enjoy the many courtesies and pleasures.

Irvin Ewing

PEONIES ARE NOT PETUNIAS

by Anthony J. De Blasi, Wakefield, N.H.

Relativity is a fact of gardening. A few peonies, well tended, outshine a large planting that has fallen into neglect. Efforts directed at having more, larger, or faster results do not always meet with success. Squeeze in another plant and you end up with less, in terms of performance. Jazz up your plants with extra food and you weaken them. Plant a large specimen—to steal time in getting a show in your garden—and it may dwindle and withdraw into itself, *doubling* the time it might have taken otherwise.

The moral, as you may have guessed, is that with peonies you can't tamper with the basics and expect to get optimum results. This of course is not to say that peonies cannot tolerate variations in culture. They are quite malleable, in fact, adapting to a wide variance in growing conditions. Nor are we suggesting that there is no margin for error or room for experiment with the variables. But there are a few simple acts of kindness that should be considered if you wish to make your peonies happy, make them at home in your garden, and make them requite your love with lavish and lasting beauty.

1. Do not bite off more than you can chew. Scale your garden to a size that will allow you to enjoy it. Keeping it cultivated, weeded, watered, edged, etc., should not be such an enormous task that you become a slave to the *maintenance* of the garden. This augurs well for failure. No matter how zealous you are now, you may not be at some other time, or you may wish to spend some time with other projects.

- 2. Plant your peonies carefully. Study the planting directions. Give them good soil and plenty of room and sunshine. Be prepared to provide them with ample water in dry spells. Place them at a comfortable distance from walls, trees, and other plants. Keep them out of hot, dry places and wet spots.

3. Be cautious in feeding them. In deep, rich soil you may be able to forget about this altogether. Otherwise, do not have a heavy hand, particularly with chemical fertilizers, and apply the food after bloom. If you can afford it, make it bonemeal. Manure is okay if it is well aged. Wood ashes are an old standby. A perpetual mulch of organic matter gradually and gently feeds the root zone.

4. Keep the soil about the plants loose, either by light cultivation and/or spreading a light organic mulch, such as dry grass clippings.

5. Be patient. A peony is not a petunia. Respect the difference. It may be two years or more before you see your plants grow into their new home and perform with the miraculous abandon for which peonies are justly famous. Enjoy their infancy. Keep a loving eye on your "babies," and don't kill them with kindness in any scheme to push them into adulthood.

EXPERIENCES WITH TREE PEONIES

Dr. Henry Landis, Q.C., General Counsel

Ministry of the Environment (Ontario)

Toronto

This lecture was given at the Floralties Internationales de Montreal, at Montreal, Canada, on June 12, 1980, by Dr. Henry Landis, Q.C. Permission was received for publication from Mr. Pierre Bourque of the Montreal Botanical Gardens, on behalf of the Floralties Internationales.

In December 1974 when I was in Japan, I had the good fortune to be introduced to Mr. Takahiro Somei, a Buddhist priest whose family had established a well-known tree peony garden at Somedera, their temple near Nara. Since December is not the normal blooming season of tree peonies, I did not look forward to visiting his garden. When I did I was amazed to see that some varieties of tree peonies were blooming even though there were several inches of snow on the ground. Each plant was covered with a bamboo teepee, open at one end for viewing. Mr. Somei explained that these winter-blooming varieties refused to bloom in other temple gardens as close as seventeen miles away.

Mr. Somei's garden contains over 4,000 tree peonies of about four hundred varieties. Since 1974 we have been exchanging Japanese varieties and the U.S. Saunders and Daphnis hybrids, which, to the best of my knowledge, were unknown in Japan at that time. In 1977, Mr. Somei visited my garden in Toronto. He has written several books in Japanese on tree peonies and I regard him as the foremost authority in the world today on the subject.

My remarks here do not summarize the available literature on tree peonies, which I assume you are familiar with, but are rather a personal account of my experiences with these plants. These experiences have frequently led me to opinions which differ from those of well-known tree peony specialists.

My earliest contact with tree peonies was about 17 years ago. I asked a friend why he had artificial flowers in his garden, and when he replied that they were real, I touched them to be sure. It was difficult to believe that such delicate, elegantly beautiful flowers could be grown in the harsh climate of Toronto. A change in temperature of 43 Fahrenheit degrees (or 24 Celsius degrees) in 24 hours is not unknown here.

I decided to grow these fabled oriental jewels as soon as possible and ordered some from a nursery in Japan. When they arrived in late November, the plant inspector reported that they were dead. They had dehydrated due to improper packing. However, I planted them anyway. It was late in the season, the beginning of December, and the planting was in a field that had been turned into a sea of mud by constant rain. I have a vivid recollection of being able to get about only by

placing boards on the ground and standing on them, scooping planting holes in the mud, putting each peony into its hole and throwing mud over it. About one week later the ground froze. To my astonishment about 70 percent of the plants survived and today are the largest tree peonies in my garden!

These two incidents illustrate the great beauty and enormous vitality and tenacity of these plants. They are rampant growers and as a result are gross feeders. I have dug fleshy roots over 3 feet in length which disappeared into hard clay subsoil almost two feet below the surface. It is difficult to believe that the roots of any plant would seek nutrients in such an inhospitable environment.

It is often suggested that several handfuls of bonemeal annually are all that a tree peony needs. In my opinion, this is incorrect and harmful advice. Like a clematis or a wistaria, if a tree peony is not given sufficient annual nutrients, its growth and vigour diminish and its production of large flowers decreases until it finally succumbs to frost or disease or just fades away. The mass of a tree peony's stems, leaves, and roots should indicate that several handfuls of bonemeal annually is insufficient. Mr. Somei recommends feeding tree peonies four times a year under his climatic conditions, in which root growth continues during the winter. The last feeding takes place in late fall or early winter. Under the climatic conditions in Toronto, I omit this last feeding. I apply fertilizer as early as possible after the snow has disappeared, again after the plants have finished flowering in the early part of June, and again in the latter part of August just before root growth in the fall. Bonemeal contains very little nitrogen and therefore cannot satisfy the nitrogen requirements of a tree peony. Both Mr. Somei and I use an organic nitrogen fertilizer, such as rapeseed meal. Bonemeal also does not contain adequate micro-nutrients. If the soil pH is high or low or if micro-nutrients have become unavailable through, as in my case, too much phosphorus, it may be necessary to supplement applications of fertilizer by micro-nutrients. I have found that yellow discolouration of foliage and a general lack of vigor have been corrected by sprayings or soil applications of zinc and iron chelates during the growing season. A soil test, including testing for nitrogen and micro-nutrients, should be carried out at periodic yearly intervals to determine an adequate program of fertilization.

Tree peonies thrive in soil rich with humus. In my garden the most vigorous growth is found in plants which are growing where the most leaf mould was incorporated into the soil when the garden was established. Because of the possibility of disease, I do not use any form of manure, although Mr. Somei recommends chicken or sheep manure.

Certainly tree peonies will survive and even appear to thrive for a number of years with an annual hit and miss application of bonemeal or other fertilizer. They are highly adaptable plants and can endure and even grow well for a time under adverse conditions, but after many years in the same location, the plant loses its vigour, diminishes in

size, becomes prone to botrytis and winter damage, produces inferior or fewer flowers, and fades away.

Good drainage is essential to the culture of tree peonies. Over the years the only cause of death of an entire plant in my garden has been botrytis in the roots, probably due to compacted and, as a result, waterlogged soil.

I have not found any references in the available literature recommending pruning. On the contrary, there are often statements that tree peonies require little or no pruning, but merely the removal of dead or diseased stems. Until the spring of 1977, I never pruned tree peonies except for these purposes. Mr. Somei visited my garden in June of that year, and so important does he regard pruning that he extended his visit for two days for the sole purpose of pruning all my plants. I was very concerned that his purpose in pruning was to achieve an appearance in the plants in accordance with Japanese aesthetics which I would not appreciate. I need not have worried. The purpose of corrective pruning is to direct the plant's energy into the production of flowers rather than leaves and to prevent disease. This is achieved by opening up the interior of the plant to sunlight and air, and checking the tendency to unnecessary vegetative growth. Analogies can be found in the pruning of wistarias and roses.

The following are some of the techniques of pruning Mr. Somei used to achieve these purposes. Only four or five main stems coming out of the ground are permitted. All growth coming out of the ground other than these stems is removed. All new side shoots coming from these four or five main stems are removed from ground level up, leaving only three or four side shoots at the top of each main stem. All shoots which appear relatively weak or which point to the centre of the plant are removed. Where side shoots which are not of the current year's growth are removed, a stub of about $\frac{1}{2}$ inch is left to prevent damage to the main stem. New side shoots are removed flush with the main stem.

If you do not prune your plants, nature will by making their dark stagnant interiors, choked with new growth, susceptible to disease. In my garden I have substantially eliminated botrytis without spraying merely by following these techniques of corrective pruning and by removing all leaves from the tree peonies after the first frost and before they fall. I have also observed a marked improvement in the production of large flowers where older plants have tended to vegetative growth rather than to producing flowers. Pruning appears to stimulate vigorous growth by the plant. This year with an electric saw I cut to ground level all of my older tree peonies, so that long, willowy stems would be replaced by shorter, thicker stems which will hold the flowers well. An old tree peony that is well-established on its own roots can be rejuvenated in this way in late fall or early spring.

I have seen well-known old collections in the eastern United States

in the process of fading away, their owners, taking for granted the myth that tree peonies require little or no care, mystified by the reasons.

The opinion has even been expressed by a well-known grower that a diminution of flower production and growth is to be expected after 10 to 15 years, this period being considered the prime of a tree peony. I think this view is incorrect and is based on inadequate hit-and-miss fertilization and the lack of corrective pruning rather than on any natural cycle in the growth of a tree peony.

The result of proper fertilization and corrective pruning is long life for a tree peony. I have seen a plant in Mr. Somei's garden which has been growing in the same location for eighty years and is in excellent condition. According to Mr. Somei, it blooms well every year.

It is often suggested that a grafted tree peony should be planted with the graft union five or six inches below the surface of the ground. While it is essential that it be planted deep enough for the buried part of the tree peony scion to root, this may put the lower herbaceous root portion of the graft in a deeper layer of soil which is likely to be of poorer quality and not as well drained. Since nutrients applied to the surface are not carried very far into soil, the herbaceous root part of the graft will receive less nutrients than if it were growing in an upper layer of soil. Depending on whether the soil is light or heavy, I have found that good results are achieved by planting the graft union three to five inches below the surface.

Tree peonies, being understorey plants, appreciate a cool, damp root run. Thus a mulch is advisable where the soil is apt to become dry for any length of time during the growing season. I have found two or three inches of coarse wood chips to be very beneficial, particularly in inducing the tree peony scion to form its own roots. Mr. Somei does not use any mulch in his garden.

It is frequently said that tree peonies should be planted in a sheltered location and that exposure to wind is likely to lead to failure. I have found this not to be the case. My garden is in full sun, faces south, and is on the slope of a ravine. The tree peonies have no protection from winds. The good air circulation resulting from such conditions appears to promote vigorous growth and to assist in the prevention of disease. A negative effect of lack of shelter may be the loss of stems during the winter. This is no great matter because if the plants have formed their own roots, new stems will quickly come from the ground and bloom the same year. I have observed that where all the stems of an established tree peony were killed by botrytis they were replaced within a period of about three weeks in the early part of June by new shoots coming from the ground.

Tree peonies can be planted in the spring, but since the plant starts growing long before the snow has melted, the effect of such early planting is a severe setback unless the plant is moved with a large

earth ball. They should only be planted, bare root, in late summer and early fall when they are dormant and can commence to grow roots in their new location.

It is frequently said that tree peonies should never be planted in soil in which peonies had been growing. I have often planted tree peonies in parts of my garden in which other tree peonies had been growing for years and, in some cases, even where an old plant had died from botrytis, and I have experienced no problems. However, I always replace two or three bushels of the old soil with fresh soil and remove as much of the old roots as possible.

I have grown the European, Chinese, and Japanese types of tree peonies and the recent Saunders and Daphnis lutea hybrids and can recommend only the last three types. The European varieties have not bloomed well or regularly for me, and the Chinese do not present their flowers well above the foliage. I have found that the Saunders and the Daphnis hybrids are more subject to winter damage than the Japanese. The Saunders and Daphnis are also slower to become established and do not grow as vigorously as the Japanese until they have become well established. Generally speaking, the Saunders and the Daphnis hybrids do not present their flowers as well and their flowers are not as large as the Japanese varieties, because the parentage of these hybrids includes the lutea species. However, their more deeply cut foliage, their greater range of colours (which includes shades of yellow, amber, and cream), and their combinations of colours in a single flower make them unique. Moreover, they generally bloom later than the Japanese types, which extends the blooming season.

To sum up, I have found that a tree peony needs more care than an azalea but less than a rose. It will flourish for decades if planted in an acceptable location and given adequate nourishment and corrective pruning. Little or no care for a long period of time spells extinction, even for a plant of such vigour and tenacity.

The wonder of these plants in bloom and their imposing presence in the garden when not in bloom is such that, once one is smitten with them, they become a life-long passion. Few pursuits in horticulture are as rewarding as growing the "king of flowers," which Mr. Harold Hillier described as "amongst the most gorgeously coloured of all shrubs."



PREFACE

The following was prepared for presentation June 12, 1980, at the conference on irises and peonies in connection with Floralties Internationales de Montreal 1980. The form of the presentation is an illustrated lecture, using projected transparencies to portray the floral and vegetative characteristics being discussed. Some photographs were selected from my existing collection and additional ones were made specifically for the purposes of this presentation.

The bibliography includes both references which directly support the content of the presentation and a selection of references relating to research on physiological processes in Paeonia, which is beyond the scope of this paper. The latter category of references are included in a spirit of supporting the interest of others in research related to micropropagation. For example, the normal growth pattern of peonies is characterized by sparse branching, making them poor subjects for in vitro techniques based upon proliferation of growth points. However, it has been shown that gibberellins overcome bud dormancy of the peonies, leading to the question of whether a propagation system might be developed which uses in vitro procedures and includes gibberellic acid in the treatment protocol.

Permission secured for publication.

Don Hollingsworth

THE NEW PEONIES: THEIR ORIGIN AND PROPAGATION

by Don Hollingsworth, Kansas City, Missouri

This is mostly a talk on peony breeding and how it is being advanced by persons working on a part-time, non-commercial basis.

The new peonies are being developed almost entirely through hybridization between species. Historically, peony hybridization is in its infancy, both in terms of the passage of time and in terms of peony generations. Most of the garden hybrids currently being distributed are of the first and second generation. Even in the hands of contemporary breeders, I know of very few plants that are as many as eight generations away from the most distant interspecies cross in their ancestry.

Garden peonies in America have been dominated by two extraordinary horticultural groups which have been selected for domestic use for more than 2,000 years. These are the herbaceous Chinese peonies of the species *Paeonia lactiflora* (syn. *albiflora*) and the tree peonies, *P. suffruticosa*. The horticultural strains of both of these species were originated in China. However, there is no evidence now obtainable that interspecies hybridization was ever involved in the development of either group. The plants of each group are taxonomically separate from any other known species. They are distinct from one another upon important vegetative and floral characters. Furthermore, they appear to be relatively primitive within the evolutionary range of the genus. With respect to breeding compatibilities, when members of either group can be induced to cross with other species the resulting hybrids are highly infertile. Thus, there is little room for doubt as to their separate taxonomic status. The extraordinary range of horticultural variation present appears to be entirely the result of the repeated selection of desirable mutants.

From the standpoint of breeders, the Chinese peonies and the tree

peonies make up the bulk of the desirable genetic capital which is available. However, due to the uniformly high sterility of the first generation hybrids, the task of merging this genetic capital with the desired characteristics of other species is especially challenging. Both species have the diploid number of chromosomes, which is ten, while the best levels of interspecies fertility in peonies are found at the tetraploid level, which is twenty. When a tetraploid is crossed with a diploid the progeny are triploid, having fifteen chromosomes. This compounds the infertility problems. Nevertheless, many highly sterile hybrids form a few fertile germ cells and an occasional seed can be obtained.

When progeny of these triploid peonies occur they are often tetraploids and the prospect that they will be fertile is very good. Thus, by carrying out a two-generation cycle one may combine two species or strains which form infertile hybrids and then re-establish a relatively much more usable fertility in their progeny. This is but *one* example of the complex effects of chromosome numbers on a peony breeder's options. The overall problem is that the larger share of horticulturally important variation is embodied in diploid species while the fertile hybrids are most likely to be at the tetraploid level.

How about using colchicine technology to obtain tetraploidy, or even hexaploidy in peonies? Some of the early workers such as Orville Fay, who was notably successful in obtaining tetraploidy in *hemerocallis*, became entirely discouraged in their attempts to double the chromosome number in peonies. It now appears that the restricted growth cycle of peonies is the critical barrier. More recently David Reath has reported success in producing tetraploid *Paeonia lactiflora* by treating germinating seedlings just after the reduction of plumule dormancy had been completed, in early spring. The rate of breeding progress from treating seedlings is slow, however; most seedlings are culls. The logical extension of Reath's finding is to work with the selected cultivars. Treat their shoots just after the reduction of bud dormancy is complete and new growth is commencing. Infertile hybrids would be changed to the tetraploid or hexaploid level, and probably would have good fertility. However, this requires research and research in peony breeding is almost entirely in the hands of non-commercial interests. Advancements sometimes come slowly when pursued on a spare time basis.

Peonies do not compete well for the resources of commercial plant breeders and nurserymen. In addition to the relatively long time from seed to flowering, they are slow of propagation. Consequently, they afford an attractive subject for persons who are seeking a creative project with which they can compete favorably on a spare time basis. The primary barrier for commercial nurserymen has to do with the economics of propagation and marketing. Peony propagation is slow due to the inherently small annual increase of growth points. The situation might change if there is a technological breakthrough in

propagation methods that will permit the rapid increase of a new cultivar to the quantities required for mass marketing. In this connection, research in tissue culture propagation of peony has been underway for several years at the University of Illinois, but the desired goal was not in view as recently as one year ago.

The Chinese peonies are generally well adapted for division of the crowns and this method of propagation remains the one that is predominantly used by commercial nurseries. In order to obtain the numbers required for general marketing, it is necessary to have a large planting of propagating stock. Under favorable conditions one division can be increased to a thousand in ten or twelve years. To obtain this rate of increase requires that the number of growth points double every year. Breeders who have developed proficiency in grafting tree peonies sometimes also graft buds of herbaceous peonies in order to enhance the rate of propagation during the early years following selection. The procedure is not difficult. However, it appears that the individual cultivars are not uniformly well adapted for grafting, just as they are variable upon other characteristics, thus potential benefit is limited.

Some herbaceous peonies are poorly adapted for crown division; this tends to be the rule in certain species groups. However, some of these have a compensating virtue in that they readily produce adventitious buds on root pieces, a capability that is almost absent from the Chinese peonies and the tree peonies. Hybrids from *Paeonia peregrina* and *P. officinalis*, two of the important progenitors of the presently available garden hybrids, are often more rapidly propagated from root cuttings than by traditional methods. I will show an illustration of budded root pieces later and discuss the technique.

A typical generation in peonies measures approximately five years or more from pollination until the attainment of flowering maturity by the seedlings. This, combined with the relative infertility of interspecies hybrids, causes the work to progress slowly. Thus peony breeding goes forward without much promise of riches for the successful. Perhaps this is responsible for the present growth of camaraderie and interdependence among the persons involved, for there is a good climate of cooperation, and a readiness to exchange plants and information is prevalent.

Interspecies hybridization of peony is largely a phenomenon of this century. The Lemoines of France offered their first lutea hybrid tree peony and a small group of early herbaceous hybrids shortly after 1900.

The most ambitious hybridizing efforts ever undertaken with peonies were conducted by Professor A. P. Saunders of Hamilton College in Clinton, New York. He undertook to collect and interbreed all of the available peony species that could be induced to grow in the climate of his area. The accumulated results were of considerable bulk, for he assigned serial numbers in excess of 17,000 to plants raised or

brought into the project during a period of approximately 30 years. His most intensive period of hybridization was carried on during the period between World Wars I and II. He introduced numerous new hybrid peony groups. While other hybridists also produced some very fine things during the same period, it is the Saunders strains which are predominantly used in current breeding activities.

The range of flower colors has been increased, and the flowering season has been lengthened. It was the Saunders work which did the most to acquaint gardeners with the possibilities of having showy herbaceous peonies in flower during a period of six weeks or more, whereas the traditional peonies are limited to two or three weeks. By crossing among early flowering species and between these and the later flowering Chinese peonies, Saunders was able to make extraordinary advancements in flower colors and size in early flowering peonies. From the species have come new flower colors and patterns in opaque whites, light yellows, warm pinks, lavender pinks, and sharp reds. From the Chinese peonies have come size, vigor, ease of garden culture, and the potential of producing good doubled flower forms. However, it remains for current and future peony breeders to complete the merging of the wanted flower colors and forms into fertile, vigorous strains which can be readily propagated. Wild type flowers predominate among the currently available early peonies, but important advancements have been demonstrated in this decade.

For the majority of peony growers, especially those who are only casual gardeners, the familiar model against which all other peonies are judged is the full double flowers of Chinese peonies. We breeders are acutely aware that our new introductions are going to be evaluated against this model. Accordingly, one of our preoccupations is the question of what the doubling mechanisms are and how they are inherited. I will illustrate with color transparencies what I understand about these mechanisms.

The wild type flowers of the peony species are the single flowers of the horticultural types. They contain sepals, petals, pollen-bearing stamens and carpels, with their stigmas which receive pollen, at the center. These carpels become the seed-bearing fruits upon maturity. The number of petals varies from about six to around eleven to thirteen, nine being quite common. Doubleness of the flowers arises from transformation of the sexual organs to petals and from the multiplication of flower parts.

Among the herbaceous species, the only type of doubleness which is known other than in the Chinese peonies is the all-over transformation of stamens. The distinguishing characteristic is that each stamen is equally transformed to petal-like forms. This is seen in cultivars of *P. officinalis*, the predominant domestic peony of early European gardens and in *P. tenuifolia*, the fern leaf peony. In the Chinese peonies the degree of transformation varies from stamens barely transformed, forming small staminodes, to petals that are approximately a cen-

timeter wide. This leads to the range of horticultural forms known as Japanese (or Imperial) flowered, anemone flowered and bomb double. Genetically, all-over stamen transformation is recessive to normal stamens. However, the degree of outward expression is undoubtedly under the control of modifier gene effects and dosage effects.

A different sort of stamen modification and one that is not clearly understood is progressive transformation. The outermost are more or less fully transformed to petals, while the innermost retain normal, pollen-bearing anthers and there are progressively transitional forms between. This sort of stamen transformation leads to the show classification semi-double form, but does not fully explain them. At least in the clones selected for horticultural use, there seems to be a multiplication of flower parts as well. Progressive transformation also occurs in different degrees of completeness. Some of the forms selected for horticultural use have only a very few stamens towards the center of the flower and are made up predominantly of petals. Doubling in the tree peony flowers seems to be of a progressive pattern.

A third source of doubling in Chinese peonies is due to flower-in-flower form. When combined with overall stamen transformation to full blown petals and the multiplication of petals, this leads to the massive full doubles which have no stamens, long considered the most wanted for exhibition. In the extremely double forms it is not possible to see the relationship of the types of doubling. However, in lesser forms, one can see the parts. This is most clearly seen when yellowish staminodes are present or when one takes apart one of the big full doubles which has stamens embedded in the crowded petals. By pulling off the outer parts first and working progressively inward, the flower parts will be seen to diminish in size down to a thin ring of stamens or staminodes and then change abruptly to wide petals again. The semi-doubles also reveal the flower-in-flower form by having a very small flower embedded within a ring of carpels at the center of the flower.

One of the missions of peony breeders is to merge the genes for doubling with the genes for the lovely color tints and hues of the present interspecies hybrids.

While doubled flower forms are maximized in the Chinese peonies, one of the long-standing challenges to their devotees has been the paucity of good crimson colors and the lack of yellows, scarlet reds, and clear violet tones. Other peony species offer these enhancements. Only the barriers of breeding incompatibility and interspecies hybrid sterility stand in the way. However, these barriers are being broken down. How rapidly this can happen is limited only by the rate at which effort is being applied to the task.

Three types of yellow flower pigments have been reported in the genus *Paeonia*. F. C. Cooper, of the National Research Council of Canada, has described these and identified their sources. One is a yellow flavone which is best expressed as the bright, light yellow of the

difficult diploid species, *Paeonia Mlokosewitchi* from the Caucasus Mountains. Combined with clear red pigments, yellow flavones are also responsible for the orangy hue of *P. peregrina* (syn. *lobata*, *decora*, "Fire King," "Sunbeam"), a tetraploid species from the Balkans.

The other two yellow pigments have been reported in the shrubby species of the Delavayanae complex of Southwest China. The carotene yellow pigment of *Paeonia lutea* is the source of yellow color in the Lutea Hybrid tree peonies and in the Itoh Hybrids, which come from the cross of Lutea Hybrids pollen on Chinese peonies.

Paeonia Potanini var. *trollioides* is reported to have a chalcone yellow pigment. The chalcones are miscible with the red anthocyanidins and should be capable of imparting good orange color, according to Cooper. If there are hybrids of this species, they are not known to me. However, upon casual examination the plants seem to be similar to *P. lutea*. The Delavayanae species are said to hybridize easily with one another. Most of the seeds currently being distributed yield flowers of mixed colors and are believed to be of mixed lineage. A seedling which I grow gives a quite smooth orange color, rather than the more characteristic blends. I wonder whether this is the sort of effect Cooper anticipates from a mix of chalcone and anthocyanidin.

All of these species which have good yellow pigments are diploids. The two which have been successfully crossed with other species give hybrids that are highly infertile in the first generation. Thus they continue the pattern of challenge which faces peony hybridists.

Saunders succeeded in making hybrids of Mlokosewitchi with several other species but not with a Chinese peony. The resulting hybrids included both diploids and triploids. Eventually a few second generation plants were obtained and some of these had the tetraploid level of chromosome numbers. These were crossed in various ways and eventually to Chinese peonies, getting some garden hybrids, but triploids again. Eventually tetraploid second generation plants appeared, some of them being more fertile. These have become progenitors of some of the most interesting approaches to yellow flowered garden peonies that are currently in the hands of peony breeders. Other sources of flavone yellow now in use are "Claire de Lune," the one known successful cross of Mloko and a Chinese peony, originated by E. B. White, and "Oriental Gold," a shaggy double yellow of unknown ancestry which was introduced from Japan. The seedlings displayed at the 1979 National Peony Exhibition included descendents of these lines showing three types of flower doubling.

Paeonia lutea and its close relative, the dark red flowered *P. Delavayi*, were first crossed with the garden tree peonies by Louis Henry and the Lemoines of France about 90 years ago. Later the cross was worked successfully by Saunders and by Nassos Daphnis in America. The resulting hybrids included flowers in hues of yellows, reds, and a range of blends. Called Lutea Hybrids, they make up a race

of very satisfactory garden plants, though generally lacking the great refinement and beauty of the Japanese tree peonies. They are diploid and highly infertile. However, a few seeds can be collected and some of the resulting second generation plants are better in fertility. Daphnis has shown that through diligent pollination the rate of production of second generation progeny can be improved.

In more recent times, Toichi Itoh, a horticulturist in Japan, crossed the yellow flowered Lemoine Lutea Hybrid cv "Alice Harding" with a Chinese peony and obtained yellow flowered hybrids. These were first reported in the West less than twenty years ago. The cross is now being repeated by North American breeders. However, the Itoh cross takes poorly and erratically. Success requires a coordination of good fortune and diligence. There is evidence that it takes better, perhaps only, on hot days. The poor fertility of Lutea Hybrid pollens aggravates the problem. Perhaps one grain in a thousand forms a pollen tube when germinated on sugared agar culture medium. Pollen production is also erratic, varying perhaps with age of the plants or with climatic factors. It is necessary to have a stock of the pollen cultivars available and to be diligent in collecting the pollen. Six or seven breeders have reported success with the cross in the past decade. I have not yet heard of success in producing second generation Itoh Hybrids. The better forms of the Itoh Hybrids are fine garden plants, with exceptionally good foliage as well as unique flower form.

I want to discuss one more example of approaches being used by current breeders, based on *Paeonia peregrina*. F. C. Stern recommended this species as a fine garden peony in its natural form. Saunders used a form of it from Amos Perry of England, which he called the "Perry Lobata." Crossing it with the Chinese peonies he produced a large number of triploid hybrids of which forty or more having warm pink and bright red flower colors have been introduced. The "Perry Lobata" was also crossed with various double flowered forms of *P. officinalis*, resulting in a tetraploid strain called the Little Reds Hybrids. Some of the cultivars of the Little Reds are highly fertile when crossed on Chinese peonies and afford the additional advantage of contributing the capacity for doubling, which they have from their *officinalis* ancestor. The resulting hybrids are triploids and, accordingly, are infertile, but not so severely as some other triploids. Some of them can be successfully back-crossed to Chinese peonies and if intercrossed with one another, will produce seedlings at the approximate rate of one for every ten to twenty flowers pollinated. As with the Lutea Hybrids, diligence in pollinating the flowers with tested pollens improves results.

The *Paeonia peregrina* descendants have the ability to readily form adventitious buds on root pieces as mentioned earlier. Sprouts are often noticed a year or two after digging a plant, coming from root scraps left in the ground. Occasionally they also appear around the perimeter of an existing plant. This quality is a valuable aid in propa-

gation. The buds form under warm moist conditions after the piece of root has been separated from the influence of the normal buds. They can be planted or kept in a plastic bag with moist medium during the time necessary for bud formation. Afterward the buds have to go through a period of cold temperature before they will grow. The buds tend to form on the lower or more distal portion of the root. Thus it is desirable to plant the pieces more or less horizontally, two or three inches below the soil surface. A nicely shaped set of new storage roots will form at base of the shoot. This propagation advantage is retained in the Little Reds hybrids and enhances their appeal as breeders.

"Good Cheer" of the Little Reds, which is perhaps most like *Paeonia peregrina* in flower, has a double white officinalis cultivar as its other parent and is perhaps thus free of the crimson flower effects common to the officinalis species. Crossed with the Chinese peonies "Good Cheer" progeny are relatively tall and quite variable in flower. Some have doubling, the same all-over stamen transformation as seen in officinalis peonies; others have extra petals. The best warm pink colors among them compare favorably with those of the finest Saunders Lobata of Perry pinks.

Another Little Red which I have tested is much shorter than "Good Cheer." It gives remarkably uniform hybrids from Chinese peonies. The effect is more like that obtained when inbred lines are mated in producing seed grown hybrid annual plants, though not entirely so. The plants are compact and the flowers run mostly to reds and pinks, of a very lively effect. They vary on these dimensions according to their Chinese peony parent, so that by using only one cultivar for the seed parent it is possible to produce strikingly uniform seedlings. This experience suggests the possibility of a seed grown strain of hybrid peonies for commercial distribution, thereby getting around the problem of slow propagation that is experienced with the asexual reproduction of clonal stocks.

One of the deterrents to seedling production of peonies as a nursery enterprise has been the uncertainty of germination. I have studied the seed germination cycle of peonies extensively and find that by using controlled environment techniques it is possible to assure maximum seedling production from a given seed lot. Basically, three different environments are required, in sequence, in order to make peony seedlings ready to grow. This is most conveniently understood as three phases of development. The seeds want a substantial period of warm, moist environment for developing to the point of readiness to root. There is little or no external evidence of change in this phase. Once a readiness for root development is reached, the seedling will remain outwardly quiescent until cool temperature (+15 °C) obtain, such as naturally occur in early autumn. Those which are ready may have remained quiescent for weeks, then a root will appear within five or ten days after having the stimulus of the required temperature. At 25 °C or more, rooting usually does not occur.

After the root comes into growth, several weeks or months of cold temperatures are required (about 5 °C or 40 °F is best) in order for bud dormancy to be reduced, comparable to that needed for mature peonies.

Individual embryos of both the horticultural strains and the interspecies hybrids vary greatly in the amount of time they require at different stages. This leads to the sometimes erratic performance of a mixed group of seeds. The most common failure of seedling production occurs when root emergence comes in late autumn. It appears that after the ground freezes, dormancy reduction goes forward only very slowly. Thus, although it is many weeks until spring, the plumules (buds) may be still blocked by dormancy and will not grow when the soil warms. These then either lay over until autumn or, more likely, weaken and die during summer.

Peony seed germination can be brought under a useful level of control by carrying seeds dry until spring and planting them out for emergence the following year. Or, steps can be taken to assure the most favorable cycle of environments by sprouting the seeds under controlled conditions. By using pots or polyethylene plastic bags containing moist vermiculite for mobility the process is manageable. The process is not difficult.

Collect seeds from the pods while they are still moist and keep them moist so that development is not interrupted. After 6 or 8 weeks, or longer if possible (up to about November 15) move the containers to a place where the temperature is about 15 °C (55-60 °F) for rooting. After it appears no more new roots will emerge, gradually reduce the temperature, by shifting to colder sites, until a temperature of about 5 °C (40 °F) is reached. A cold root cellar, storage cave, or regulated refrigerator all offer very satisfactory conditions. Don't bring the seedlings into growing temperature until the plumules are observed to be stretching upward. This is the only reliable indicator of this readiness to grow.

I believe that controlled germination of peony seeds can be carried on in a practical way in large quantities, suitable for general nursery production, assuming an attentive propagator is directing the work. This fact should not be overlooked by peony breeders. What is indicated is to identify fertile matings that will give uniform progeny having desired attributes. Getting set up for production is a matter of establishing a suitable planting for the desired level of seed production.

Peony breeding is a fascinating and potentially rewarding study for persons who enjoy working with plants. It is currently an area of plant breeding where the work of persons not having commercial interests is in the forefront of discovery and creativity.

Persons who are interested in keeping up with the progress of this study should affiliate with the American Peony Society. Available

publications include a quarterly bulletin, a hybridists' newsletter, and various reference books. *The name and address of the secretary is Greta M. Kessenich, American Peony Society, 250 Interlachen Road, Hopkins, MN 55343.*

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LABELING

If one has purchased fine varieties of peonies and planted them with care, he certainly wishes to know their names when they bloom, so a suitable label is very necessary.

For small gardens, keep a planting record or diagram in your home, as well as labels on the plant. Records should be made at planting time, not trusting to memory if records are made later.

BONE MEAL: IS IT A GOOD FERTILIZER?

Question the value of bone meal as a fertilizer and someone is certain to rise and say, "If you're so smart, why is it that our grandfathers (or fathers) have used bone meal for years and have been satisfied with the results?"

This accusation has a very simple answer. Comparing the bone meal of grandfather's day and the commercial product sold today is like comparing a dish of old-fashioned oatmeal with a serving of devitalized, dehydrated corn flakes. They are not identical.

In the potting shed on big estates in England, or perhaps the hen house on humbler properties, there stood a bone grinding mill operated by a huge wheel. It was used to crush bones from the kitchen and was used either as a poultry feed or a garden fertilizer. Into this mill went fresh bone, perhaps from a rare roast with bits of meat still clinging to it. The marrow contained blood and also some phosphorus still in transit in the animal when slaughtered and not deposited as insoluble tricalcium phosphate, the basic building block of skeletal matter. The ground bone contained as much as 6 percent nitrogen.

In addition to kitchen wastes, many other sources of nitrogen were tossed into the mill. A head gardener was not above salvaging dead chickens and stillborn piglets to enrich the ground bone.

Behind every bothey (a dormitory for apprentice gardeners) stood a huge pile of peat, which served as a urinal for the occupants. The ground bone was mixed with this peat or other dry matter such as sawdust to make a more workable product. The mixture contained every element needed for full plant nutrition.

How does this compare with the dry, white bone meal of commerce? Today, bones are a valuable source of packing house by-products, elements needed by plants but worth far more in other forms. The bones are steamed to extract gelatin and other by-products. This removes most of the amino acids, a valuable source of nitrogen. Further processing removes all but about one-half of one percent of the nitrogen. What is left is a substance considerably less desirable as fertilizer material.

Recently, I had an occasion to examine a lawn on which the owner had faithfully applied 50 pounds of bone meal every spring for 20 years. It was poor in color and growing poorly. A divot removed from the turf showed a distinct white line, nearly half an inch deep, just below the surface. Among other adverse effects, this layer of bone meal had locked up practically every trace of iron, robbing grass plants of a basic nutrient needed for chlorophyll formation. It is obvious that today's bone meal is not what it used to be. In fact, it may sometimes do more harm than good when added to the soil. —R. Milton Carleton

Permission given for reprint, R. Milton Carleton, News and Views, American Horticulture Society

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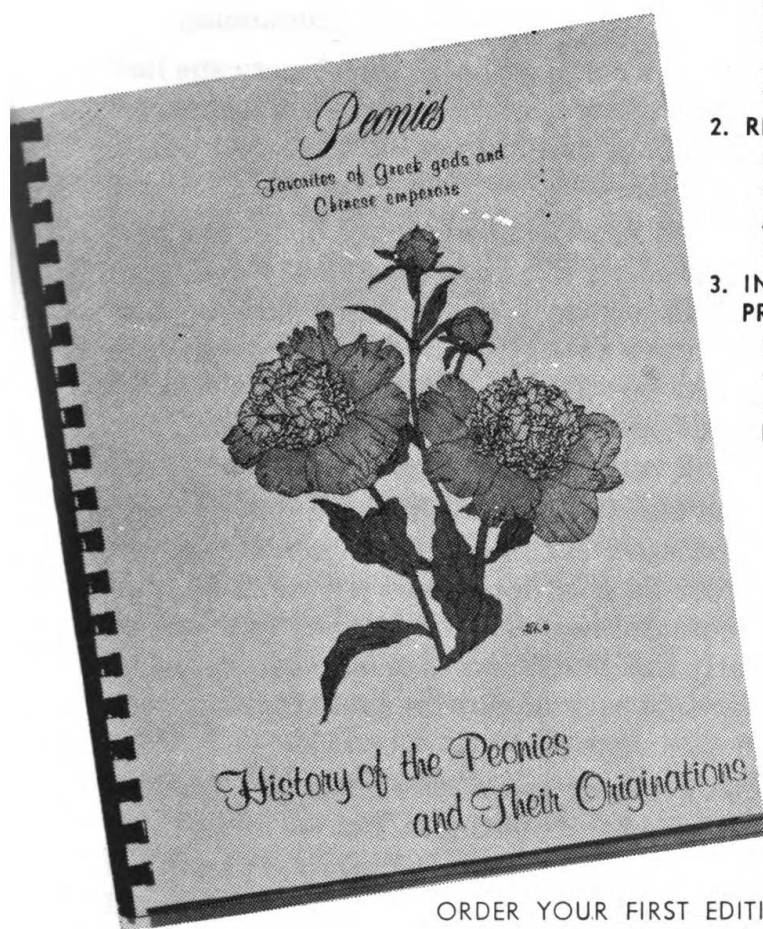
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COMPOSTS CAN HELP A HEAP IN SAVING RESOURCES

by Chuck Slocum, of The Minneapolis Star's Board of Contributors

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in which the article first appeared Aug. 21, 1980.*

Compost—A fertilizing mixture of rotted vegetable matter combined with animal manure and consisting of alternating layers of plant and animal substances piled upon one another and allowed to decay.

—Webster's Dictionary

It's hard to get excited about a compost heap. But Americans had better start getting seriously interested in these wood-framed, three-sided outdoor boxes in which garbage decomposes, because if we don't, we may all be neck-deep in rubbish.

You probably have heard that Americans represent about one person in 20 in the world yet devour nearly a third of the planet's available resources every day. Our "throwaway" convenience society has become the lubricant for the American way of life, according to some critics, as the energy needed to turn a single person's yearly necessities into usable materials amounts to nearly three tons of coal, 1,300 gallons of gasoline and 89 cubic feet of natural gas.

Now, a compost heap can't melt and recycle aluminum, copper, lead, steel, zinc or plastic. It doesn't even burn wastepaper or boxes. But if each of us had one in our backyard, perhaps we wouldn't need 500 new dumps this year to join the 14,000 existing ones. Perhaps we could hold the line on the nearly half-million acres of land being used to store the 2,000 pounds of garbage each of us will generate during the next 12 months.

I am hardly an expert in compost heaps. We used them in Boy Scouts to keep our camp sites clean and smell-free, but we never hung around long enough to see them work. Just a few months ago, I started one which is now devouring our corn cobs, meat scraps, egg shells and potato peelings. You throw the stuff in the box, cover it with dirt or ash, and let Mother Nature do the rest. The garbage decomposes and turns into rich dirt, which can be used to fertilize gardens to grow more corn and potatoes. It usually takes between six months and a year to complete the process.

Other vegetable matter used to stimulate the decaying procedure consists of leaves, lawn cuttings, rotted hay or chopped cornstalks. The best composts have flat or sunken tops so that they can collect rain water. The materials should be stacked in tiers no more than a foot thick. Layers of animal waste are often part of a compost.

You can talk all you want about expensive recycling plants to melt down cars and other precious metals, sophisticated energy-conservation systems to construct into homes and buildings or streamlining the costly methods used to package our consumer goods.

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Yet each of us can't personally do much about that right now.

But we each *can* build a compost heap. By doing so, we are contributing to the "Good Planet Earth." We must hold out hope that the fragile world America's astronauts fondly looked upon from the moon a decade ago will be around 100 years from now in the kind of condition that will reflect well on us.

All that, and it doesn't cost us a dollar. A compost heap is one of the few remaining bargains.

TREE PEONY TOPICS

Louis Smirnow, 85 Linden Lane, Brookville, N.Y.

To answer a number of questions, I am repeating several items which appeared in previous Bulletins.

The question has been asked if tree peonies can be divided as can herbaceous. Some tree peonies can be divided but not until they are several years old. We have never been able to divide any tree peonies under seven to ten years.

Be sure to feed your peonies a few weeks after blooming. Do not feed in the fall because tree peonies are in a dormant stage then. Feeding with super phosphate is successful. One fine grower feeds his peonies with fish emulsion.

The past season we saw a tree peony with over eighty blooms on it in Long Island. Another plant had over sixty blossoms. We asked the growers what methods of cultivation were used. Both stated that deep holes were dug at the time of planting and that superphosphate was mixed with the soil. Try this method.

Weather plays an important part in the size of blooms. During a rainy season, Shujakumon flowers will grow to be fourteen inches; Shintenchii, twelve inches; and Gekkyuden, twelve inches. Other twelve-inch flowers and even larger are Stolen Heaven, Hanakiso, Red Moon, Beni Chidori, and Rimpow.

If you dig or receive a young grafted tree peony showing rot on the roots, do not feel that the plant is deteriorating. It is merely an indication that the understock is decaying and that new roots are beginning to form at the union of the scion and the understock.

Watch the new growth from the root system in the spring. Be sure that this new growth will have tree peony foliage and not herbaceous. Should the latter show, be sure to remove the entire stem down to the roots. Occasionally the herbaceous understock will show growth.

It has been my experience that quite a few people do not plant a young tree peony properly. It is absolutely necessary that the joint of the understock and the scion (the top part) be planted at least two inches below ground level. In northern climates, four to six inches would be desirable. The root system must be below the ground level. Please remember that tree peonies perpetuate themselves by new growth from the root system below the ground. This new growth forms the new branches.

INDEX TO THE TREE PEONIES OF HAO PROVINCE

by Hsueh Feng-hsiang

*A First Translation from the Original Chinese by John Marney,
Associate Professor of Chinese, Oakland University*

(Translator's note: Hsueh Feng-hsiang was a man of the Ming dynasty, 1368-1644. His native district of Hao, in modern Honan province, was famed for its tree peonies, and Hsueh's own garden, we are told, boasted many rare varieties. His claim to fame lies in this Index.)

In ancient times, Pan Meng-chien [i.e., the great Han historian, Pan Ku, A.D. 32-92] produced an "Index of Men" in nine sequences and grades. Chung Hung [an important literary critic, d. 518] placed poetry into precedence and categories [i.e., the *Shih-p'in* Categories of Poetry; in three grades, or categories]. If there are only to be four [categories], then the distinctions among things must be between large and small, refined and rough. How much more so is it in respect of divine flowers! Their changes and fantasies, and a hundred wonders all resolve into great beauty, which may be appreciated and enjoyed. If one were to offend against such natural principle, then what means would he have of answering to the Creator, and making apology to the Flower Divinity!

And so, their significance goes beyond their immediate appearance. Their beauty is born in accordance with externals; their spiritual feelings are free and vigorous. Their divine radiance glows in profusion, as if rising upwards, as if soaring aloft; wishing to startle, wishing to be intimate. They are like Wu O emerging from the gorge; and Mi Nu crossing the waves. [Wu O was the goddess of the Wu Mountain mists, who appeared one night in mortal form before the king, hunting in the mountains. In the morning, she resumed her form as the clouds and mists. The story is told by Sung Yu (3rd century B.C.) in his Rhyme-prose on the Kao-t'ang Park. Mi Nu was the daughter of the legendary Fu Hsi, who was drowned in the Lo River. She became a river goddess.] Thus they are called "Divine Category."

When it comes to those one thinks of as being of jade enrichment, pearly luster, bright splendor, languid charm, extravagant manner, beauteous disposition, throbbing soul and fettered spirit, then they are the Li Yuan of the Han house, and the Cheng Tan of the Wu palace. [Li Yuan was a girl at the court of Emperor Wu of Han (r. 140-87 B.C.). At the age of fourteen, her jade-like skin was soft and supple, and her breath was sweeter than the orchid. Whenever she sang, the court musician Li Yen-nien would invariably accompany her; and when she sang the "Whirlwind," the very flowers of the courtyard would turn and fall (themselves embarrassed by her beauty). So frail was she that she could scarce bear the weight of her robes; and the emperor had constructed for her a special marquee lest any dust fall upon her. Cheng Tan was a beautiful lady of Yueh state during the Spring and Autumn

period (771-479 B.C.), who was presented to the ruler of Wu state, to the latter's great delight.] Thus they are called "Renowned Category."

There are also fantastic forms and magical shapes, extraordinary varieties and strange genres, showing off their hues, diffusing their radiance, and never the same appearance. Are they not "dragon's spit"? [said to have caused the birth of the beautiful but sullen Pao Ssu; attempts to make her smile brought about the fall of the Western Chou regime in 771 B.C.]. Are they not "fox tail"? Thus they are called "Marvelous Category."

In the categories of outer standards within the realms of beauty, then competing in cultured refinement is the delicate delicacy of the Carmine Fairy of the Wu clan, and the graceful grace of the Little Jade of the Huo family. Thus they are called "Talented Category."

Again, there are the carmine lips and jade countenances, glossy flesh and ample sinews; gazing to the magical rue at the Red Coral Tower; viewing the beauteous blossoms at the Flowered Well. All may inspire a man, and are worthy paragons. Thus they are called "Potential Category."

Otherwise, there are those of fascinating colors, whose elegant grace is like powder and perfume, and whose glossy richness is like Lady Hsu [i.e., the wife of Emperor Yuan of the Liang dynasty, r. 552-554. Lady Hsu's biography, with details of her amorous affairs, appears in John Marney, "Lady Hsu of Liang," *Odyssey* Vol. 1, No. 2, April, 1976, pp. 19-23.] who, when old, was discarded but to the end remained of romantic disposition. So too like the Concubine P'an coming upon the scene, as if shy, as if hesitant [P'an Yu-erh was a concubine of the sixth ruler of the Ch'i dynasty, r. 499-500. In 501, the dynasty fell, and the new emperor considered that P'an's great beauty, upon which great wealth had been squandered, had been a cause of the Ch'i's demise. P'an hanged herself.] The "Ta Ya" [section of the Confucian classic, *Book of Poetry*, 1000-600 B.C.] makes no mention of them, but their lingering fragrance still remains. Thus they are called "Drawn Up Category."

I have made an index of the flower categories.

Divine Category

Heaven's Fragrance Single [prime, or unique] Category
Lovely Face of Three Transformations
Peerless Red
Vermilion Crimson Robes
Surpassing Brocade
Greater Yellow
Lesser Yellow
Gold and Jade Exchanging Radiance

Yellow Flannel Spread Upon Brocade
Rose-color [lit. silver-red] Loveliness
Embroidered Robes Red
Soft Petal Rose-color
Jade-green Gauze Lantern
New Red Loveliness
Palace Brocade
Flower Red Embroidered Ball
Rose-color Embroidered Ball
Flower Red Densely Coiled
Heaven Planned Brocade

Rose-color Transgression
Fang Household "Flying
Swallow" Adornment
"Flying Swallow" Red Adorn-
ment

Cherry-apple Red
New Rose-color Ball
Fang Household Rose-color
Broken Petal Flawless Jade
Green Heart Flawless Jade
Mei Province Red
Emerald Flower
Cotton Cloth Snowy Peak
Nameless Three Varieties
Gold Thread Robes
Five Mounds Springtime
Flower Red Solo Victory
Flower Red Matchless
Boudoir Beauty
Golden Chamber Loveliness
Lovely White Without Peer
Cloud Pale
Perfect Purity

Renowned Category

Surpassing a Lovely Face
Broken Jade Ring
New Red Embroidered Ball
New Red Wondrous Sight
Pomegranate Red
Pomegranate Flower Red
Flower Red Folded Kingfisher-
blue
Autumn Water Adornment
Old Rose-color Ball
The Concubine Yang [Kuei-fei, a
beauty of T'ang, d. 756] Deeply
Intoxicated
Flower Red Divine Category
Soul of the Cherry-apple
Flower Red Level Head
Flower Red Dancing Green Lion
Rose-color Dancing Green Lion
Flower Red Pre-eminence
Pre-eminent above Ten Thousand
Flowers
Western Pre-eminence above Ten
Thousand Flowers
Crimson Gauze Lantern
Azalea Red
The Concubine Yang's
Embroidered Ball

Tai [?] Liu Yellow
Greater Pale
Lesser Pale
Pale White Tower
Jade Girdle White
Jade Girdle-pendants
Jade-green Jade Tower
Jade Hairpin White
Cockatoo White
Competing With Sheep's Wool
White Crane's Neck
Jade Tablet White
Emerald Toppling Jade Tower
Buddha Head Blue
[ultramarine]
Phoenix Tail Flower Red
Original Substance [gold]
Evening Adornment
Enduring Charity Red
Celery Leaf Flawless Jade
Even Kernel Red
Rose-color Brocade
Embroidery
Wei Red
Skirts and Screens Charming Red
Plum Red Scissored Velvet
Flower Red Tasseled Fringe
Heartsick Serving-girl Charm
Han Palace Springtime
Ink-black Mallow [or Sunflower]
Glossy [lit. oil] Red
Ink-black Scissored Velvet
Ink-black Embroidered Ball
Mid-Autumn Moon
Glass Vase Watered Vermilion
Lotus-root Fibers Even Head
Ten Thousand Folio Book
Peach Red Ten Thousand Folio
Book
Ch'iao Family Water Melon
Abundance
Peach Red Water Melon
Abundance
Entering the Palace Robes
Charming Red Tower Terrace
Trusting to New Makeup
Bordered with Broken Jade
Flower Rouge
Adornment of Yao's [daughter]
Ying [3rd millennium B.C.]
Chang Family's "Flying
Swallow" Adornment

Rose-color Splendid Adornment
Thatched Hut [lit. white room]
Nobleman
Competing with Jade Eminence
One Color with Jade-green Sky
Yellow and White Embroidered
Ball
Fine Weather Charm
Rare Color Shining Eyes
Rare Color Monopolizing Pre-
eminence
Rose-color Wondrous Category
Lien City Jade
Jade Enrichment White
Jasper Terrace Jade Dew
Ice Pure White
Lotus-root Fibers Rainbow
Garments
Coral Phoenix Head
Rose-color Incomparable Singing
[-girl]
Third [month of] Spring
Eminence
Marvelous Category
Joined-in-Pleasure Charm
Revolving Branch
Bewitching Blood
Washed Face Charm
Talented Category
Melon Abundance Yellow
They're Not Sunset Clouds
Concubine of the Lo River
Hsi Shih in the Flesh
Tipsy Hsi Shih
Better than Hsi Shih
Foreign Hsi Shih
Kuan Yin Appears [Buddhist
Goddess of Mercy/Fertility]
White Dancing Green Lions
Jade Heaped-up Red
Jade Hibiscus
Embroidered Hibiscus
Added Color Smiling Face
Jade Tower Springtime Snow
Gold Refined Snowy Waves
Rose-color Eminence
Chang Family "Flying Swallow"
Adornment
Jade Beautiful Woman
Light Gauze Red
Everywhere, Charming

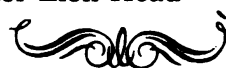
Flawless Jade
Green Edged White
White Lotus Flower
Rose-color Mahayana [Buddhist
"Great Vehicle"]
Variegated Sunset-clouds Silk
Rouge Bordered Powder
Potential Category
Coral Tower
Clear Moon Red
Great Fire Pearl
Peach Red Phoenix Head
Original Substance Crown
Ma Family "Flying Swallow"
Adornment
Leaning against a Balustrade
Charm
Ch'iao Red
Great Charming Red
Charming Red
Five Clouds Tower
Jade Tower [whereon] Kuan Yin
Appears
Tipsy Orang-outang [or Scarlet
Red]
Jade Hare of Heavenly Fragrance
Limpid Jade
Dozing Crane Immortal
Kuan Yin's Face
Peach Red Dancing Green Lion
Tipsy Immortal Peach
Uncolored Luan-bird Charm
Shedding Purple Retaining
Vermilion
Flower Red Competing with
Tower Terrace
Jade Tower Springtime
Large Leaf Peach Red [Leaf/
petal]
Crinkled Leaf Peach Red
Jealous Charm Red
Sheep-fat Jade
Jade Embroidered Ball
Shen Family White
Even Head White
Late Arrival White
Tipsy Concubine Yang
Crane Feather Red
One Hundred and Five
Rouge and Powder Tower
Peach Red Cotton Thread

Red Cotton Thread
Lotus-root Fiber
Embroidered Ball
Persian Head
Greater Added Color Smiling
Face

Drawn Up Category

Wang Family Red
Top Candidate Red
Gold Flower Top Candidate
Sprinkled Gold Peach Red
Girdling gold Purple
Light Lotus-root Fiber
Purple Dancing Green Lion
Great Red Dancing Green Lion
Powdered Dancing Green Lion
Reed-whistle Flower Dancing
Green Lion
Lotus-root Fiber Dancing Green
Lion
Lotus-root Fiber Tower
[Red] Glass Beads Red
Longevity Springtime Red
Lotus Stamen Red
Sea and Sky Sunset-clouds
Goat's Blood Red
Four Faced Mirror
Shih Family Red
Peach Red Tower
Old Monk's Hat
Ch'en Province Red
Rouge Red
Even Head Red
Gold Cotton Thread Red
Great Red Embroidered Ball
Great Red Treasure Tower
Terrace
Variegated Sunset-clouds Red
Seven Treasures Charm
Cinnabar Red
Fine Petal Shou-an Red
Coarse Petal Shou-an Red
Pirouetting Powdered Hsi Shih
Fine Petal Red
Western Heavenly Fragrance
Palace Springtime Perfume
Palace Springtime Eminence
Felicitous Heavenly Fragrance
Crystal Ball
Jade Heavenly Immortal
Powdered Red Tower

Better than Heavenly Fragrance
Tipsy Springtime Countenance
Powdered Embroidered Ball
Powdered Double Tower
Makeup Red
Better than Dark Red Peach
Auspicious Fragrance Purple
Purple Fairy Immortal
Hsu Family Purple
Purple Double Tower
Whistle-reed Flower Purple
Candle-Lantern Purple
I.e., Ink-black Purple
Petal Base Purple
Whistle-reed Color Purple
Whistle-reed Bark Purple
Purple Tasseled Fringe
Clove Purple
Even Head Purple
Purple Embroidered Ball
Jade Double Tower
White Scissored Velvet
White Tasseled Fringe
Jade Embroidered Ball
Jade Bowl
Green Heart White
Fu Family White
Phoenix Tail White
From out of the Lips White
Jade Basin White
Pien City White
Lotus Fragrance White
Whistle-reed Color Tower
Clear Color Lion Head



SPRAYING OR DUSTING

To prevent disease, spraying or dusting should be practiced more generally than it is. The first spraying or dusting should be done just as the plants break through the ground. It should be repeated when they are about half grown and again just before they bloom. To prevent leaf spot they should also be sprayed or dusted several times after blooming. Use bordeaux or some similar fungicide.

Annals of the Flowers

Ch'iu Tao-yuan's [i.e., Ch'iu Hsuan, fl. 1040] "Treatise on the Exalted and Lowly of the Tree Peonies" says, "Extend to them the natural season; prosper them with the benefits of the soil; regulate them with human care. Cuttings and graftings will then be without exhaustion and without extinction; their growth and their maturing will neither diminish nor congest." I therefore chart the annals to make known the cycle of decline and decay. When the time comes for the work to be done, give the order for grafting. If the tree peony seeds take, then in the 2nd year they are called "infant"; in the 4th year they are called "sapling"; in the 6th year they are called "sturdy"; and in the 8th year they are called "strong." Those grafted in the autumn by spring are called "sapling"; by the Grain Rains [April 20-May 4] are called "sturdy"; in the 3rd year are called "strong." Both grown and grafted must be divided. Divisions of 1 year are called "sapling"; of two years are called "sturdy"; of three years are called "strong"; of 8 years are called "ended"; of 12 years are called "venerable"; and of 15 years are called "old." When venerable, they decay; when old, then daily they fail. Those grafted a second time and divided a second time that decay and daily fail should be started again, nearer the root. When spring comes, these are called "sapling"; 1 year, they are called "sturdy." This is the way of preserving youthful appearance. The Annals Chart best secures the enquiry of cutting, grafting, growing, and maturing; and excels as the record of natural time, benefits of the soil, and human care.

Seed

1 year; 2nd year "infant"; 3rd year; 4th year "sapling"; 5th year; 6th year "sturdy"; 7th year; 8th year "strong."

Graft

Autumn division; beginning of spring "sapling"; Grain Rains "sturdy"; 1st year; 2nd year; 3rd year "strong."

Division

1st year "sapling"; 2nd year "sturdy"; 3rd year "strong"; 4th year; 5th year; 6th year; 7th year; 8th year "ended"; 9th year; 10th year; 11th year; 12th year "venerable"; 13th year; 14th year; 15th year "old."

WINTER WEATHER 1979-1980

Warmer weather this past winter was a welcome repass, but it took its toll with perennials in the garden, notwithstanding the peony. Some reported that large plants were diminished in size, few bloom stalks, and buds did not develop from the time that growth began, leaving the stalk with a small brown bud. Plants were damaged and weakened by the unusually early hot weather followed by freezing temperatures, and cold, wet weather, caused botrytis and/or phytophthora blight—at least the conditions looked and acted like these par-

ticular blights. Spraying seemed to do very little to check the problem. In addition, the erratic weather caused winter kill in various perennials and much frost damage to strawberries, raspberries, and other plants. We can do very little about frost damage, and this, no doubt, was more of the cause of our peony problem this spring.

It takes a strong, healthy plant to endure the rigors of this past winter. The symptom of buds not developing, with stalks having small brown pea-like buds, is just the process of self-pruning. This occurs in plants that do not have enough vigor to make flowers. Cultivation and fertilization will solve much of this problem. Plants can be fertilized with a light feeding in the late summer and early fall and again in the early spring. These conditions may be different in various parts of the peony-growing area, as we know that there are pockets of cold, frosty air in contrast to quite normal temperatures a few miles distant. Problems occurring in a season are similar in the north and midwest states in many respects. We must consider the weather when unusual problems occur in the garden, whether it be with peonies or other hardy perennials.

Botrytis Blight — Boyds Manual

This disease has been reported to occur throughout the geographic range of peony-culture. Frequently it is epidemic in wet springs and may destroy the bloom in entire plantings. It affects the stems, buds, and leaves, beginning in the spring as the shoots emerge. Infected stems show a dark-colored area at the base or just below the soil-surface. The discolored and injured portion may be shallow, so that the foliage appears but little affected, though the buds are blasted, or the infection may extend so deeply that the leaves and stem blacken, decay, and die. The rotted parts become covered with a brown, felt-like coat of fungus-spores which are borne in minute heads on tiny stalks. These spores are spattered by rain, or carried by air-currents and by insects to other parts of the plant, particularly the buds, where the sugary exudation furnishes an ideal medium for lodgment and germination. As a result, one bud after another may become infected. Buds attacked at an early stage turn black and dry up; larger buds turn brown and fail to open. Often the flower-stalk is rotted off. Some buds nearly reach the flower stage before succumbing, or open flowers may be attacked, resulting in deformed, undersized blooms with a brown, decayed center. The leaves may be more or less generally affected with irregular brown spots, or on some of the shoots are killed outright. The severity of the attack is influenced greatly by the wetness of the weather; and the stage of a generalized attack following blighting of the buds may not appear in a dry season. In wet seasons the stem-rot may extend into the crown and prepare the way for root-decay.

This blight is caused by parasitic fungi of the genus *Botrytis*, the gray mold. An early and a late form of the blight are attributed to different species, but for the purpose of this discussion may be treated as

one. The fungus lives over winter in the form of small, black, pimple-like sclerotia or resting bodies, attached to dead stems or decayed portions of the crown, by disintegration of which they pass into the soil. Their germination in the spring gives rise to a crop of spores which may infect the emerging peony shoots, no form of injury being necessary to prepare the way. However, a mulch about the bases of the stems at this time aids infection by holding moisture, even though the material used in mulching is not itself infested.

Other Blights and Leaf-Spots

Another foliage-blight, which resembles that caused by *Botrytis*, is caused by the fungus *Phytophthora*. It has been found in several localities and may occur in many more, possibly being mistaken at times for *Botrytis*. In general, the affected parts are darker brown or nearly black. The buds and foliage seem to be attacked first, but under suitable weather conditions entire shoots may be blighted. Resting spores are produced in the infected parts, which are probably the means of surviving the winter, but whether the same fungus also invades the crown, penetrating and causing rot there, is as yet unknown. Fungi of this type are very susceptible to the toxic action of copper so that spraying with Bordeaux would probably prevent the destructive occurrence of this disease, except in very wet weather.

Fungicides, Benlate, Captan, and Phaltan Are Also Recommended

Small insects, called thrips, sometimes infest peony buds and flowers so severely that the buds fail to open and the flowers are ragged, spotted, and short-lived. Badly infested buds might be mistaken for those blighted by *Botrytis*. These insects multiply in weeds and trash, so that proper spacing and clean culture are often an effective means of combating them.

Root-Knot or Root-Gall

These terms are often used as synonymous, although root-knot in other plants has come to mean the particular kind of gall caused by the parasitic eelworm, *Caconema radicolola*. This eelworm, or nematode, is often found in small knots or galls on the minor roots of peonies, particularly during the summer after many new roots have been formed. Again, galls which appear superficially identical are present, yet no nematodes of the root-knot types can be found. The fact that this disease is more prevalent in southern than in northern regions is in accord with the view that the root-knot nematode is the cause, yet the difficulty so often encountered in demonstrating that this parasite is present in affected roots makes it unsafe to conclude that this is the full explanation.

A somewhat different type of root-deformity is that in which the fleshy roots are swollen, stubby, and abruptly constricted at the ends or present a series of small, bead-like swellings. There are usually only a few, short, more or less rotted fibrous roots. The examination of such

specimens usually fails to reveal the presence of root-knot nematodes; and it is sometimes assumed that if eelworms are implicated they were present only in the initial stage of the attack while their effects persist, or that this is a different kind of disease.

The gnarly, irregular form of peony crowns which are too deeply buried has been mentioned. Another form of overgrowth of the crown and roots resembles the plant tumors, called crown-galls, which occur in various nursery plants, as fruit trees and shrubs, roses, chrysanthemums, etc. These galls result from infection by a specific bacterial parasite, which gains entrance through propagating wounds and slight injuries during cultivation, but not much is known about this type of infection in peonies.

The plant symptoms associated with these various root-deformities are: (1) Absence of bloom, or few and weak flowers; (2) spindly stems and thin, small leaves which are usually rolled lengthwise; (3) pale green color.

The means of prevention and control are: (1) Avoid planting roots which show a galled or knotted condition; (2) if plants develop these top symptoms, investigate the condition of the root, discarding it if badly diseased or dividing it into small (one-eye) portions which should be transplanted to a different site, if the plant is not badly diseased and is considered of sufficient value to warrant the extra care; (3) the soil in which an infected plant grew should be excavated and replaced with fresh soil (4) if this trouble becomes general in a planting, disappointment and loss of time will be saved by discarding the old plants and starting a new bed elsewhere with healthy stock.

PEONY SEEDS

Our peony seed pool has been supplied with gems from the garden. Seeds are available to anyone for the asking. Send \$1.00 for postage to

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List of available seed:

1. Serenade F2
2. Quad F3 x Silver Dawn F3
3. Quad F3
4. Quad F4
5. Tetraploid mixture (from Roy Pehrson's select plants)
6. Moonrise F2
7. Moonrise x Archangel
8. Lactiflora mix
9. Minnie Shaylor (lactiflora)
10. P. Suffruticosa (tree peony)

From Gus Sindt:

Hazel Brand - pink anemone
 Faribo Gold - white jap yellow center
 Topeka Garnet - red single

Gay Paree - lovely jap or anemone

Walter Faxon

May Lilac - single white hybrid

Rose Bowl - single pink

Kay Tischler - pink jap

From Don Hollingsworth:

Tree peony seeds from Linda Hall Library

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Macro hybrids

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officinalis hybrid - red single

Tree peony seeds

Lactiflora seeds with some

others mixed in

PROPAGATING BY DIVISION OF ROOTS

by James Boyd

When peonies become too old and flowers begin to get small and stems rather crowded, it is advisable to divide the roots; or, if one wishes to sell or give a certain variety to friends, he may do so by carefully dividing the roots, either in the spring or the fall. The latter time is preferable because the bloom for that year is not lost, and the flowers the following spring are generally as numerous and as good from the fall-planted division as they are from the division planted six months earlier.

Amateurs should not divide a plant that is less than three years old, but commercial growers who desire to increase their stock as rapidly as possible can successfully divide two-year-old plants.

To divide a clump, the first important thing is to dig it up carefully. A three- or four-year-old plant will generally have roots 12 to 15 inches long, and the spread will be between 20 and 30 inches. Dig around it and under it in order to pry and raise it without cutting or breaking the roots, which are rather brittle when they are first exposed to air. When the plant is free, lift it out of the ground and shake it to remove as much of the earth as possible, and then let it stand in the sun and air for two to three hours. When it begins to wilt, the roots will have become softer and more pliable and may be handled without much danger of breaking. Then, holding the plant by the leaves and stems, wash off all the soil, either in a tub of water or by using a garden hose. When clean, remove the tops within 1 to 2 inches of the topmost bud. Next, examine the clump closely, holding it in both hands. Work or bend it back and forth slowly to determine where it seems inclined to part. If it bends readily in one or two places, these are the points at which it should be cut. A short, stiff-bladed hunting knife is very useful, because one often has to pry the roots apart as well as cut them.

When the clump is divided into two or three main parts, examine each part carefully to see where it may be cut or divided again with as little injury as possible to the roots. If a root should accidentally be broken off without an eye on it, throw it away because it never can make growth. Sometimes a very small eye may be concealed under dirt, and when the root is thrown away this eye will develop and in time send up a shoot, eventually making a plant. This will take time, and unless the variety is extremely rare and expensive, it is not worthwhile to endeavor to get a plant from a division with only one very small eye. It is very important to remove all pieces of root from the ground when plants are dug, otherwise roots with concealed eyes may form plants in years to come and cause much confusion by mixing varieties.

There have been many arguments in regard to the size of the division, but it is generally conceded that the greatest success comes from

the strong standard division having three to five eyes. A division with one or two eyes, planted in a light, friable soil, will generally thrive and make a good plant in two to three years, but a standard division in the same soil should make a good plant a year sooner. A small division in heavy clay soil will not make a good sized plant in less than three to four years, and the results at the end of the first or second year are generally so disappointing that one is inclined to dig it up and throw it away, unless it is a very valuable variety.

I have planted roots of all sizes and have found the standard division the best and most satisfactory in every way, but the novice often thinks he would like to buy a big plant, and hopes thereby to get an abundance of bloom almost immediately. This is a great mistake. Often a large plant will not develop all its eyes in the first season, and at the end of two or three years a plant grown from a good division will be much finer than a larger clump that has been transplanted. It is a great mistake to purchase old, heavy clumps with the expectation of getting immediate results; a standard division having three to five eyes will make an entirely new root system and give far better results in a very short time.



1. The A. P. Saunders Medal, awarded "for outstanding contribution to the peony," needs to be reactivated. History: First conceived in 1953 shortly after Dr. Saunders' death by Mr. L. W. Cousins of London, Canada, the medal was a long time in generating. (At one time, we had *five* pages of requirements and stipulations.) Finally in 1968 the award was first made—to both Mr. Auten and Mr. Wister. In 1972 two medals were again awarded, this time to Mr. Toichi Itoh of Japan and to Mr. Cousins himself. In 1973 two were again given, to Roy Pehrson, now of Lafayette, Minnesota, and to "The House of Gratwick," namely William Gratwick and his long-time partner Nassos Daphnis. In 1974 it was given to Silvia Saunders; since then it has not been awarded.

2. But that doesn't mean the breeders have been standing still. No, in the last two or three years our shows have been sparked with new hybrid seedlings which are bringing desirable new qualities to the flower. I refer to more yellow (purely in the herbaceous side of the peony lineage, without the use of *P. lutea* or the Itoh hybrids); more doubleness (whereas hybrids are usually single—eight to twenty or thirty petals per bloom); and greater fertility (whereas hybrids, especially in the first generation—the F-1's—are usually pretty sterile). And all these qualities, moreover, have been introduced into *early-blooming* hybrids.

3. Therefore, since it appears that there are plants, and breeders, standing ready to receive the medal, it should be reactivated. In the early days, it was the Peony Round Robin that would make a recommendation to the Society Directors, who would then award the medal. Greta Kessenich, whom I consulted, writes: "Since the Round Robin has gone out of existence, so have the regulations connected with it. Please take the situation in hand, appoint a committee, and start this program of encouragement. It could then be carried on with interest and energy." Thank you, Greta.

—Silvia Saunders

A committee is now being appointed, and the A. P. Saunders Medal will be awarded. —Editor

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