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About the Institute
The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

garden

cafy - double space - Willard
work sheet style

For the amateur working without heated greenhouse facilities or comparable appliances there is no advantage in sowing azalea seed before moderately warm weather. In the neighborhood of Washington DC this may be late March or mid-April according to the season. Germination is slower than under greenhouse conditions and may spread over a longer period before it is complete. The young seedlings will be correspondingly slower in developing true leaves.

As under greenhouse conditions it is possible to start pricking out the seedlings into transplant flats as soon as the worker cares to begin the work, but the writer has found more satisfactory results can be obtained when there were 3 or 4 good leaves before beginning. If it is possible to do all complete this operation by continuous work rather than by intermittent work such as was possible for the writer, the young plants develop more uniformly.

In transplanting the worker need not make any anxious effort to transplant the seedling at precisely the same level it occupied in the seed flat but should err always in having it a little deeper, as new roots will form on the radicle above the point where the original root emerges. This is an advantage in handling any seedlings that may have become drawn and elongated before transplanting is completed.

¶ In handling the transplants seedlings, moisture
should be kept uniform by watering and the
humidity in the frame should be high
but not excessive. A pane of glass over the
flat for the first week is helpful. Full
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readily in reduced light. As top growth becomes
more active, more light can be admitted but it
should not be forgotten that azaleas in their
early stages are not demanding of light. In fact
the more the worker studies them, the more he
becomes aware of their tolerance of reduced
light both as seedlings and as small
rooted cuttings. Watering, as for seedlings
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For the worker who has ample room and
abundant help, the seedlings are set about
two inches apart each way, no matter how
small they appear at the time. For those
who do not, the transplants can be set closely.
The writer regularly puts 200 plants in the
flat that would have contained not more than
60 by the other method. The disadvantage
of the latter practice is that
the later growth of the seedling is not
as great or as symmetrical as that of
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much likelihood of branching on the original
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shoals from the base, until after the plants are set in nursery beds.

As the writer ~~has~~ set a slow development for his work, the seedlings were kept growing only so that they would be large enough to go through the winter in the frames or pits without cold injury. They are set out in nursery beds the following spring as soon as danger of frost is over.

Transplanting is accomplished by cutting with a sharp kitchen knife, between the rows and between the plants in the row. They can then be lifted out with a piece of fibrous soil usually full of the root mass. They can be set into the nursery beds, in holes that are made with the water + dibber.

If the beds can then be shaded lightly no watering will be needed for a week. In the writer's garden the shade was given by a covering of ~~bare~~ branches. Once this shade is removed, watering should follow as needed. As practiced here, the beds were cultivated lightly with a hand fork and then watered by hand with a light rose. If the soil mixture in the bed contains enough peat or other humus, once well soaked, it will need only light waterings to maintain even moisture. As soon as the plants had grown enough, a light mulching of half-decayed leaves is spread, almost fitted between them, after the soil had been well soaked. This admits

watering by hose or can without any risk that the young plants be crushed to earth or splattered. Neither is fatal, but each either seems to retard growth somewhat.

In this area, seedlings often make their best growth during July & August, only slowing up as nights begin to cool by mid-September. The writer has no experience in the use of fertilizers for seedlings, but it seems reasonable to assume that since the whole plant is made up of "new growth", it should not be encouraged to grow so late that it would be entirely immature when frosts arrive. Growth is most easily checked by reducing the watering.

In the writer's experience with seedlings handled in this way, and under the far from ideal conditions under which he worked, there was negligible winter loss. Very few plants have been killed outright. Many of those which lost the tops, the majority sprouted from the crown at the ground line, and with a little care in watering soon made good plants most of which came through the second winter with no injury.

Enough plants will flower the third spring to keep excitement high and after the third spring, the principal business of culling the "discards" becomes a major task, to be added to the tasks of record taking, if the seedlings are hybrids made with the purpose of creating valuable new varieties. The beginner, probably, should limit his culling to the removal of plants with

conspicuously poor flowers, in color or form. The experienced grower may safely destroy also those that are obviously plants that will develop poor habits.

Nothing has been said about the distance at which plants should be set in transplant beds. This is determined by the space available and the convenience of the worker. The young plants will produce flowers, even if crowded and only the symmetry of the bush habit may be obscured. The writer, who has been limited in both time and space has followed the crowded system, but offers no defense for it other than his necessity and the fact that the plants do shelter one another in their earlier more vulnerable years.

4 azalea.

When the writer first undertook to grow azaleas and rhododendrons from seed, he followed the instructions given him by the late William H. Hatfield (verify first names). The flats were filled with a typical azalea soil mixture to which one third by bulk of coarse sand was added to insure quick drainage. This was firmly pressed ~~into~~ to a level and covered with a thin layer of sphagnum moss that had been screened through a screen. The whole flat was set in a pan of water over night. By morning all was uniformly moist. The flat was allowed to drain until no more moisture ran out. The seeds were then broadcast on the surface & then covered by a thin layer of screened sphagnum. The flat was covered with glass & one thickness of newspaper.

In time this was modified at the U.S. Plant Introduction Garden, Glenn Dale, Maryland, by the ~~dis~~ observation that the young plants grew best if transplanted early and were kept growing without further check. Since their root systems were entirely in the sphagnum layer, it was obvious that the soil below was not needed for the period of germination and some weeks following. Thereafter the much shallower flats were filled with roughly chopped sphagnum in place of soil, pressed firmly & levelled as before. On this was spread the same surface layer

of screened sphagnum but the seeds after sowing were not covered with a second layer of screened moss. The great advantage of this same in the reduced handling weights. The later advantage appears in the fact that none of the common damping off organisms were able to survive in the sphagnum moss. and there was no source of infection from below. It has been shown that plants can be kept growing slowly, ~~and~~ with no losses in such flats, no matter how crowded, if the moisture is kept at a reduced level, for from two to four years.

These reserves are sometimes of great value if the original transplants suffer accident or loss.

The writer has used both methods and can testify that the sphagnum method is entirely satisfactory under "home" conditions. The only word of warning is that ~~a flat of~~ sphagnum should never be used twice, even if the surface has been covered with a fresh layer of new screened sphagnum.

In his own work the writer looks upon the sphagnum seed flat merely as a germinating apparatus from which the plants are removed as quickly as possible. He has found it practicable to sow his seed, not broadcast, but in lines about 1 inch broad and ~~one~~ 1 inch apart. This makes possible the sowing of an enormous number of seed in one flat which saves space early in the year.

The disadvantages of this method appear only if the worker is slow in ~~working his~~ transplanting as the seedlings will become drawn and leggy as would any other crowded seedling. Recovery from legginess depends somewhat upon the blood lines involved, all of which is observed quickly enough by the workers.

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As an experiment, seed of several hybrid lots were kept growing in a cool greenhouse, with no rest, from germination until flowering. These first plants to bloom produced flowers in 14 months, but most required 18, about half the time of outside plantings. There has not been enough need to rush flowering to warrant general use of this practice. The example was of interest also in that the crosses involved a considerable amount of blood of R. indicum which is not one of the species most responsive to greenhouse life.

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Azalea.

Rough draft date of pages - Tell me please -

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The capsules were gathered, put in open, small coin envelopes & left at room temperatures. Gradual darkening to brown color followed on the capsules of themselves, but many of them showed no signs of opening after 2 months. All were then opened by crushing, using a small bottle as the crusher, and the seed poured out in each case. The only visible difference was in color, the hue being slightly less intense than that of bush ripened seed.

Germination the following Spring showed no difference either in time nor in the vigor of the resulting seedlings.

An October harvest has become routine practice here.

Time to sow seed. As far as has been observed there is no best time, other than that time which fits best into the grower's routine. The ideal goal is that the newly germinated seedling should have as long an uninterrupted first year's growth as may be possible. If one has the facilities and can spare and afford the space the seed can be sown almost immediately after harvest, and with whatever adaptations of facilities may be needed to provide extra light in winter, the seedlings can be kept in continuous growth, at least in the case of those species that tend to continuous growth as a normal bush habit. Mr. Albert Close (over

using the normal facilities of greenhouse space at the U.S. Plant Introduction Garden, Glenn Dale, Md., kept two lots of hybrid seed involving many species and clones of the Obtusum sub-series, in continuous active growth so that the first flowers appeared in 14 (?) months. This material may have been more favorable than most since its bloodline contained a large percentage of a garden clone that flowers easily under winter conditions. Very little other evidence of this line was apparent in the populations.

Without having tried it experimentally, the writer can only report that he would be inclined to doubt if continuous growth could be had from definitely deciduous species. It is entirely possible that their period of dormancy could be shortened and broken by cold treatment, but this would not alter the cyclic pattern.

Working as an amateur, without greenhouse facilities and only after office hours for work, the writer has found it more convenient to sow his seed in March by which time there is sufficient sun-heat to warm cold frame and unheated pit greenhouse. Germination and subsequent growth rates are slower than would are found in heated-houses, where seed can be sown ~~comfortably~~ if from mid-January on. If it is sown earlier & if no additional light is provided, the seedlings tend to a state resembling winter dormancy from late December to late February, from which it is not always easy to rouse them into equal growth. The difficulty is more apparent with seedling rhododendrons, using that word in its popular sense to denote evergreen species.

The writer admits that his working routine builds up delays since the seedlings are slower to reach the transplant stage and he is slower to get all the work done with the result that hence work that should have been completed in April is barely finished by the end of July, if he has thousands of seedlings to handle. The tempo of all operations, however, is adjusted to his work schedule and he has to accept the cumulative loss of a year, before he may expect flowering.

It seems worth while to record the experience not only to encourage others who may lack professional equipment, but to show once more how easily the azalea will accept a wide range of growing conditions.

As further evidence it may be noted that self sown seedlings under the parent bushes, where conditions are even more competitive, develope with an even slower tempo but according to the same pattern.

~~First transplant~~ Method of sowing To use any other method than that of sowing on sphagnum moss seems complete folly.

A shallow flat or pot of convenient size is filled to ¾ inch from the brim with tightly packed chopped sphagnum moss that has never been used before. The flat or pot is set in a container of water and allowed to stand over night. It is then stood aside to permit all excess water to drain away. Press the surface level and then cover it with a ½" layer of sphagnum that has been scrubbed through a sieve mesh of ⅛" square. This must stand until it is uniformly moist. The seed is then sown on the surface, the receptable covered with a pane of glass & a sheet of newspaper. No more attention will be needed until long after germination has taken place.

Temperatures ranging between 60-70° F bring on germination within two weeks for most azaleas. Lower temperatures produce slower results. One may watch the seed absorbing moisture & fattening before the tip of the radicle begins to show. It is interesting to watch the seeds through germination as occasionally one finds a lot that are not uniform in time.

If the moss is fresh, there will be no losses from any of the damping off fungi common in this area. The writer learned by experience that an old flat even if completely resurfaced with a deeper layer of sifted sphagnum no longer protects the germinating seedlings.

Pricking off. This again is a matter of convenience, related to facilities. For the worker in the greenhouse where atmospheric humidity can be maintained, it is perfectly safe to transplant the seedlings ~~then~~ before any true leaf has formed. With conditions similar to those of the writer, it is much better to wait until 2 or 3 true leaves have formed.

The soil mixture for the transplant flat should be the usual azalea soil mixture with about one third, by bulk, of coarse sand ~~by bulk~~ to insure rapid draining. The flats should need little drainage material as such, if the soil mixture is correct. They can be prepared, watered copiously, and drained before using or they may be used at once, and then stood in water until moisture shows on the surface, when they will be removed to their place on greenhouse bench or frame. Shade must be given. No additional water will be needed for several weeks, by which time there should be active signs of growth. Greenhouse temperatures - 70°.

Each worker handles the seedlings according to his own ~~manner~~ skill. The seedlings though small, even tiny, are remarkably tough. They can be pulled out of the sphagnum and dibbled into the prepared transplant flat. Should the root or hypocotyl be damaged, plant as if sound and whole, but a little deeper than normal. New roots will be thrown off out from the hypocotyl. If by accident a seedling falls over on the seed flat, roots can be observed all along the hypocotyl, as well as from the growing radical end. The one ~~rule must be~~ requirement, is kept, that soil moisture & atmospheric humidity are about constant: their degree does not appear to be as important as their uniformity.

Any seedlings not needed can be left in the original seed pan almost indefinitely and without feeding. To prevent too rapid growth, the degree of moisture should be much less than that given to seedlings in active growth.

Where space is not at a premium, broadcast sowing is desirable. The writer works under limited space conditions and sows his seed in broad rows that are spaced about 1" apart. Germination is excellent but seriously crowded. If it were possible to prick out the seedlings quickly no harm could follow. It is not and the result is that many seedlings become seriously stunted before they are handled. No damage has resulted if they are planted more deeply than they had been growing. These data are included not as advisable or to outline a desirable practice but to show again that the azalea is not as difficult as certain older texts would suggest.

Space between seedlings in the transplant flat must be determined by the space at one's command and the speed with which they can be rehandled for the next lift. As the Plant Introduction Gardens flats are usually spaced about 2" apart each way; in the writer's home garden, never over 1" apart and a few extras for good measure. The widely spaced plants are ready for permanent nursery beds that same season: the writer's the following Spring.

Nursery transplant. The well grown seedlings described above are ready for planting out-of-doors in nursery condition by late summer or early autumn. The decision must be made by the grower and will depend upon the severity of his climate and the amount of hard wood present at the base of the plant. Frequently there is almost none. When it is possible, the first winter should pass in a cold frame. Lacking frames, a light mulch of leaves & a cover of brush will suffice. The crowded, smaller seedlings must go through the winter in a frame, but need no special protection. They can be set out as early in the Spring as desired and if they are

as discussed cared for will almost catch up with the better plants after the summer's growth is finished.

In this climate, and so presumably in others, the young plants should be set out at a distance so that they will touch one another by the end of summer and provide mutual protection the following winter.

Transplanting is the easiest of operations. One merely cuts between the rows & between the plants in the row and lifts out the individual plant with its square prism of roots. Occasionally in the crowded system, a plant will have made a crooked main root that is cut off too close to the plant. In that case the top should be cut back two thirds. In general practice, one may plant out the young seedlings at any time of day in any temperature, provided, about ½ pint of water is poured into the hole as the plant is set & the hole closed as the water disappears. A light shelter to provide broken shade for a week will hasten the adjustment but the writer has moved small seedlings successfully in mid-July with no shading whatever. Rarely is there any wilting and when it does occur, it disappears after the first night. The more quickly the plant is established the more quickly it can resume the summer's full measure of growth. Subsequent nursery care is the same as for any other small plant, with regular attention to moisture & food.

The well grown plants will give almost 100% bloom the third year whereas the plants produced under the writer's more casual system, give only an indication reading the third year.

First Flowering In all cases observed by the writer, the flowers that are poor in size or form can be immediately discarded. Color sometimes improves a little and large flowers sometimes appear larger, but the small bloom with pinched corolla lobes, usually stays just that way.

Gathering of Seed. It has been customary to say that when azalea seed is ripe, the capsule opens naturally. Observation here suggests that the capsules, if ripe, open only after a frost. Since the writer was primarily concerned with the harvest of seed resulting from crosses, he had no wish to risk any possible loss of seed by such casual opening. It seemed desirable, therefore, to risk one year's harvest about October 10, a date generally safely before the usual "first frost". The capsules were full size, but entirely green in color.

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As further evidence it may be noted that self-sown seedlings under the parent bushes, where conditions are even more competitive, develop with an even slower tempo but according to the same pattern.

Method of sowing. To use any other method than that of sowing on sphagnum moss seems complete folly.

A shallow flat or pot of convenient size is filled to 3/4 inch from the brim with tightly packed chopped sphagnum moss that has never been used before. The flat or pot is set in a container of water and allowed to stand over night. It is then stood aside to permit all excess water to drain away. Press the surface level and then cover it with a 1/2 inch layer of sphagnum that has been scrubbed through a sieve mesh of 1/8 inch squares. This must stand until it is uniformly moist. The seed is then sown on the surface, the receptacle covered with a pane of glass and a sheet of newspaper. No more attention will be needed until long after germination has taken place.

Temperatures ranging between 60-70° F. bring on germination within two weeks for most azaleas. Lower temperatures produce slower results. One may watch the seed absorbing moisture and fattening before the tip of the radicle begins to show. It is interesting to watch the seeds through germination as occasionally one finds a lot that are not uniform in time.

If the moss is fresh, there will be no losses from any of the damping-off fungi common in this area. The writer learned by experience that an old flat, even if completely resurfaced with a deeper layer of sifted

sphagnum no longer protects the germinating seedlings.

Pricking off. This again is a matter of convenience, related to facilities. For the worker in the greenhouse where atmospheric humidity can be maintained, it is perfectly safe to transplant the seedlings before any true leaf has formed. With conditions similar to those of the writer, it is much better to wait until 2 or 3 true leaves have formed.

The soil mixture for the transplant flat should be the usual azalea soil mixture with about one third by bulk of coarse sand to insure rapid draining. The flats should need little drainage material as such if the soil mixture is correct. They can be prepared, watered copiously and drained before using or they may be used at once, and then stood in water until moisture shows on the surface, when they will be removed to their place on greenhouse bench or frame. Shade must be given. No additional water will be needed for several weeks, by which time there should be active signs of growth. Greenhouse temperatures F.

Each worker handles the seedling according to his own manual skill. The seedlings, though small, even tiny, are remarkably tough. They can be pulled out of the sphagnum and dibbled into the prepared transplant flat. Should the root or hypocotyl be damaged, plant as if sound and whole, but a little deeper than normal. New roots will be thrown out from the hypocotyl. If by accident a seedling falls over on the seed flat, roots can be observed all along the hypocotyl, as well as from the growing radical end. The one requirement is that soil moisture and atmospheric humidity are kept about constant. Their degree does not appear to be as important as their uniformity.

Any seedlings not needed can be left in the original seed pan almost indefinitely now without feeding. To prevent too rapid growth, the degree of moisture should be much less than that given to seedlings in active growth.

Where space is not at a premium, their broadcast sowing is desirable. The writer works under limited space conditions and sows his seed in broad rows that are spaced about one inch apart. Germination is excellent but seriously crowded. If it were possible to prick out the seedlings quickly, no harm could follow. It is not and the result is that many seedlings become seriously elongated before they are handled. No damage has resulted if they are planted more deeply than they had been growing. These data are included not as advisable or to outline a desirable practice but to show again that the azalea is not as difficult as certain older texts would suggest.

Space between seedlings in the transplant flat must be determined by the space at one's command and the speed with which they can be rehandled for the next shift. At the Plant Introduction Garden they are usually spaced about two inches apart each way; in the writer's home garden, never over one inch apart and a few extras for good meaure. The widely spaced plants are ready for permanent nursery beds the same season - the writer's the following spring.

Nursery transplant. The well grown seedlings described above are ready for planting out of doors in nursery condition by late summer or early autumn. The decision must be made by the grower and will depend upon the severity of his climate and the amount of hard wood present at the base of the plant. Frequently there is almost none. When it is possible, the first winter should pass in a cold frame. Lacking frames, a light mulch of leaves and a cover of brush will suffice. The crowded, smaller seedlings must go through the winter in a frame, but need no special protection. They can be set out as early in the spring as desired and if they are assiduously cared for will almost catch up with the better plants after the summer's growth is finished.

In this climate, and so presumably in others, the young plants should be set out at a distance so that they will touch one another by the end of summer and provide mutual protection the following winter.

Transplanting is the easiest of operations. One merely cuts between the rows and between the plants in the row and lifts out the individual plant with its square prism of roots. Occasionaly in the crowded system, a plant will have made a crooked main root that is cut off too close to the plant. In that case the top should be cut back two thirds. In general practice, one may plant out the young seedlings at any time of day in any temperature, provided about one-half pint of water is poured into the hole as the plant is set and the hole closed as the water disappears. A light shelter to provide broken shade for a week will hasten the adjustment, but the writer has moved small seedlings successfully in mid-July with no shading whatever. Rarely is there any wilting and when it does occur, it disappears after the first night. The more quickly the plant is established, the more quickly it can resume the summer's full measure of growth. Subsequent nursery care is the same as for any other small plant, with regular attention to moisture and food.

The well grown plants will give almost 100% bloom the third year whereas the plants produced under the writer's more casual system give only an indication reading the third year.

First Flowering. In all cases observed by the writer, the flowers that are poor in size or form can be immediately discarded. Color sometimes improves a little and large flowers sometimes appear larger, but the small bloom with pinched corolla ~~leaves~~ lobes, usually stays just that way.