NEW ZEALAND Plants and Gardens

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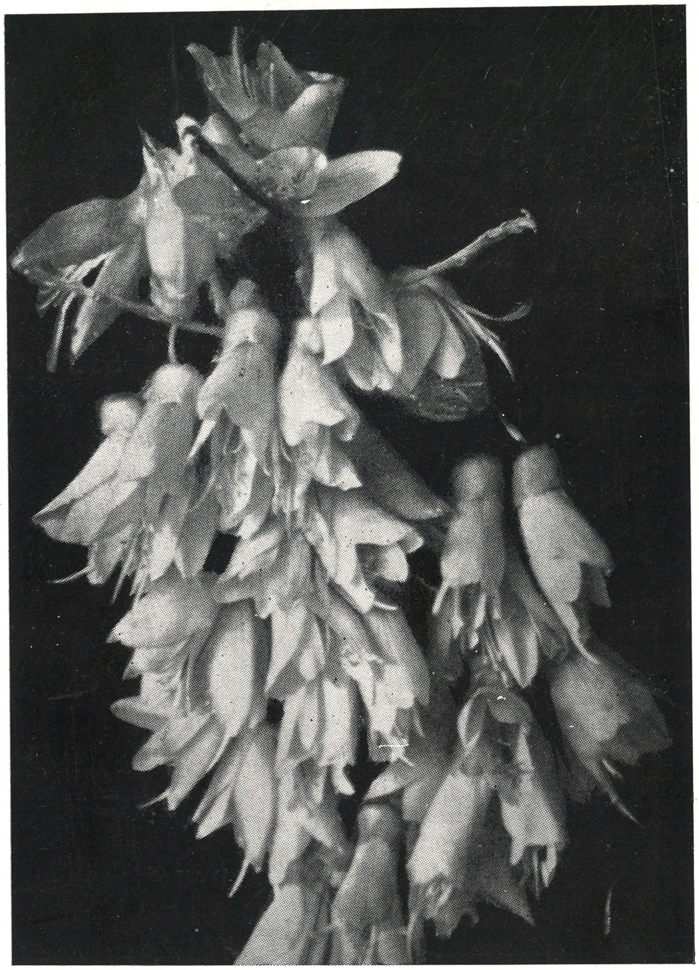
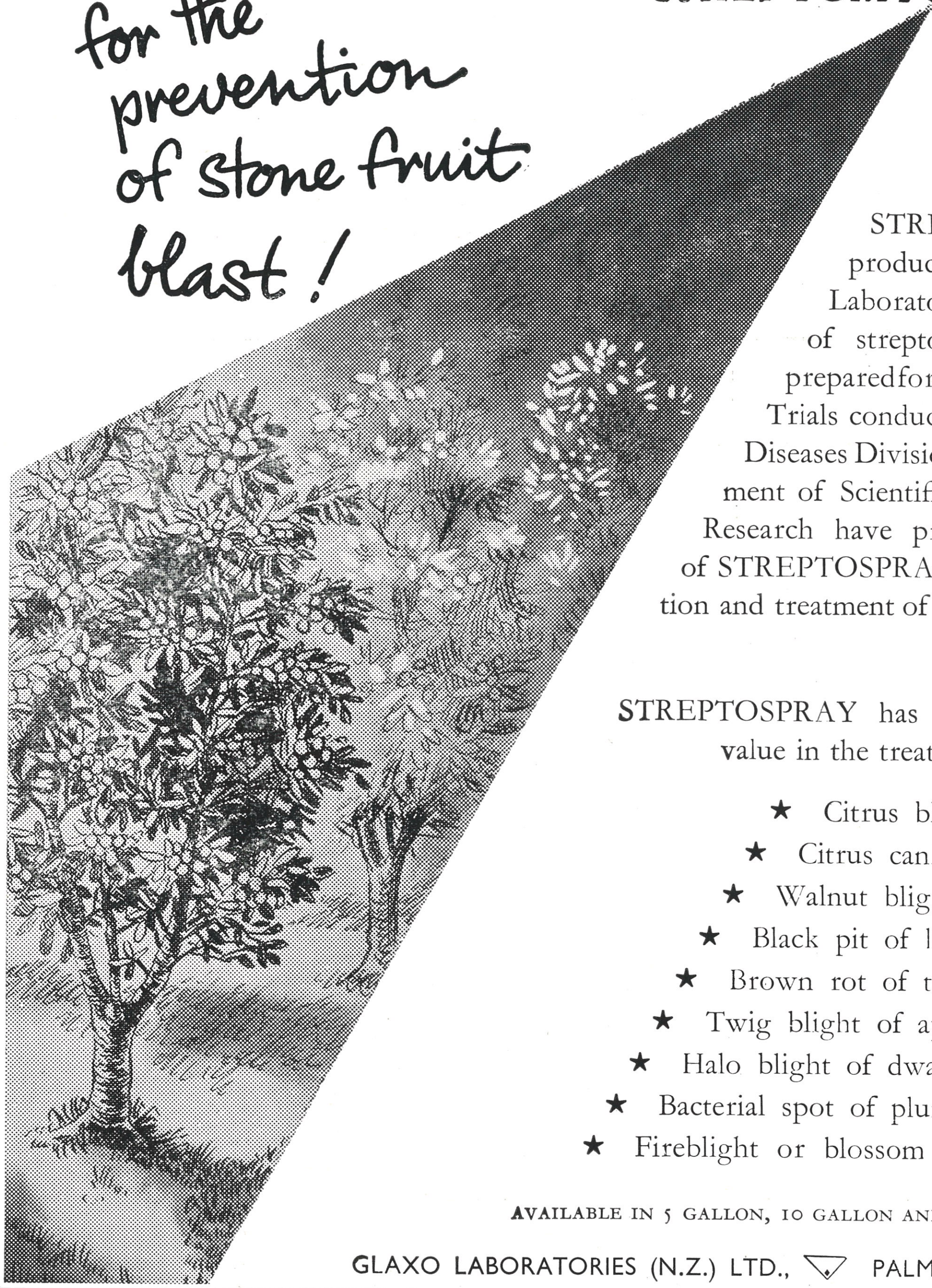


The Official Publication of the Royal New Zealand Institute of Horticulture (Inc.)



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Editorial . . .

To Have Ones Cake

MANY of us would become frustrated if we were unable to utilise the proverbs to illustrate our meanings, and on this occasion the old saw is the most appropriate method to express a thought which has simmered in some minds over the last few years. There is a body of opinion, both within and outside our organisation, which holds that the Institute has placed itself in the position of the small boy who, having eaten his cake, wishes he still had this delicacy on his plate.

This opinion can be best understood by reference to two statements commonly heard within the Institute. The first is that, "This Institute is the leader of horticulture in New Zealand. It is the Parliament which can best present the picture of horticulture on a National basis." The second statement is "Most of our members are home gardeners, and therefore not interested in anything except amateur gardening. We must, therefore, keep away from matters scientific, lest we offend them." If these are not the actual words used, they at least convey the meanings which the speakers have had in their minds.

Now, in fact, both these statements are true. This Institute should become the leader, or one of the leaders, of horticulture in this country, since by its very constitution it is in a position to parallel the work of the Royal Horticultural Society of England. Yet one is often asked, what has the Institute done for horticulture in New Zealand? One points with pride to the Institute's examinations, but here the flow of oratory commences to fade. True, many District Councils can point to monthly meetings with large attendances, at which the fundamentals of horticulture are expounded, often, like the blossoms, "born to blush unseen and waste their sweetness on the desert air." Other District Councils find that this role is already being carried out by local horticultural societies.

At this stage it becomes difficult to disagree with the rhetorical question, and one is left with the uncomfortable feeling that there should surely be some other way in which the Institute might aid horticulture. Perhaps it would be worth while—but no, the majority of our members would not be interested. It would be scientific and therefore dull. We must keep it bright and interesting. Perhaps it is at this stage that our scientists tend to leave, to lend their attention to other organisations. The few horticultural scientists who belong to the Institute lend weight to this idea.

This then is the cake which we wish to eat, and yet retain. On the one hand, to be the leader; on the other hand, not to take the lead in the improvement of horticultural knowledge and practice. The two cannot be reconciled!

It is true that the home gardeners form the bulk of the members of the Institute, but some decision must soon be made as to the policy which the Institute will adopt. If the scientist is to be virtually excluded from the Institute, then the way is clear, but let it be remembered that it is impossible to drag oneself up very far by tugging at one's own bootlaces.

Correspondence and articles for publication should be addressed to The Editor, c/o. The Royal New Zealand Institute of Horticulture (Inc.), P.O. Box 1368, Wellington. Small advertisements and enquiries re trade advertisements should be addressed to Industrial Publications, P.O. Box 6402, Te Aro, Wellington.

In Retrospect

This issue of "Plants and Gardens" sees the first year of its life completed, and the Institute as a whole can place itself in the position of a proud parent viewing its offspring. The question we must ask ourselves is whether or not this infant we have brought into being will develop to adulthood, and play a useful part in the community.

One question which must be asked is whether this infant journal is being given sufficient nourishment in the matter of contributions from members. In our first issue an appeal was made for contributions; with the exception of the usual few supporters this appeal has fallen on deaf ears, with the result that the Journal has read as somewhat of a monologue. This is not, as someone suggested, because the Editor considers himself the only person who can write. Indeed, the facts are rather to the contrary. His writings have been more of necessity than desire. Once more the appeal is made to the Institute; there is no justification for this Journal unless it be to publish the contributions of its members.

With this issue, the Editor thankfully lays down his pen, and the reins of responsibility pass over to Mr. G. A. R. Phillips. In passing over this responsibility the Editor wishes to thank those who have made contributions in the past year, and to express his sincere hopes that this infant publication will continue to devlop into a successful adult.

Book Review

PLANT PROPAGATION PRACTICES

By JAMES S. WELLS.

(The MacMilland Company, New York, 1955)

This is an entirely new and most refreshing book review on plant propagation. Its author is an Englishman who has worked in the U.S.A. for ten years, and his writing combines the good features from both sides of the Atlantic. His style is easy and direct, with a minimum of local words and expressions which in so many books confuse those in other countries.

Textbooks on plant propagation in use up to the present time are rather dull and uninteresting—partly because they try to cover every possible aspect of the work, but largely because many of the methods, machinery, and illustrations they use are antiquated.

Mr. Wells has written a very different sort of book; a personal and stimulating account of his subject.

The first half of the book deals with principles—choosing a nursery site; building and heating propagating structures; water, heat and light, and shading; followed by one chapter each on propagation by seeds by cuttings; on aids to rooting cuttings; on humidification and constant mist; on grafting; on layering and division; on pests and diseases; and on producing "liners" suitable for field planting.

The second half of the book consists of eighteen brief chapters, each one dealing with the propagation of one type or group of woody plants—Japanese maples, azaleas, rhododendrons, Buxus, camellias, cypress, Cornus, Cryptomeria, holly, junipers, magnolias, andromeda, spruce, lilacs, yew, and thuja.

The whole book is a delightful one to read, because it is so obviously an account of the author's own practical experience, rather than a dull compilation, at second or third hand, of other people's work. Limiting the account to his own experience does of course, reduce the scope of treatment somewhat, and we note for instance, practically no mention of the use of polythene plastic film in propagating. However, such omissions are slight in relation to the excellent treatment of what is dealt with.

This is a thoroughly stimulating and excellent book which will be of great value to those who propagate trees and shrubs.

J.S.Y.

In This Issue . . .

Vegetative Propagation of Bulbs

M. Richards, B.Sc.Hort. (Notts.), N.D.H., N.D.H.(N.Z.)

PLANT propagation is of most intense interest to practically all horticulturists, but although many instructions are given for the propagation of most garden subjects, the vegetative propagation of bulbs often remains a mystery. In this review are included the main methods used in artificial propagation. Many of the methods may be able to be applied to other bulbs, and this may be worthy of trial.

HYACINTHS.—The hyacinth does not increase rapidly by natural division and, commercially, various methods are used to gain rapid increase of the bulb. One of the most important of these is "scooping." The bulbs are scooped a few days after lifting, as soon as they are dried. The basal disc is scooped out of the bulb, using a tool which resembles a teaspoon with sharpened edges. The basal disc is removed down to the junction of the leaf scales. After scooping the bulbs are stored in dry conditions, at temperatures of about 60 degrees Fahrenheit. During the next three weeks, healing of the cut surface occurs, and while this is happening a mould may appear on the cut area. This seldom causes any harm, but is easily controlled by dusting the surface with "Thiram" dusts. Following this healing, the bulbs are stored in more humid conditions at 70 degrees Fahrenheit until planting time. During this period numerous small bulbs are formed over the cut surface. The original bulb is planted in the soil in autumn, and in spring the young bulbs will develop foliage leaves above ground. When these leaves have died down the young bulbs may be lifted. It will be found that the parent bulb has disappeared, having been absorbed by the young bulbs during their development.

This scooping is generally restricted to strong growing varieties. With these the method gives the greatest increase in number, but with weaker growing varieties the method may sometimes fail. For these bulbs, the cross cutting method is generally employed. In this method the base of the bulb is cut with two cuts at right angles. After cutting the bulbs, they are treated in exactly the same way as the bulbs in the scooping method.

Both these methods have one disadvantage. They completely destroy the original bulb. To overcome this difficulty another method has been developed.

The use of scale segments has been adopted from the scaling method of propagating Lilium, which is referred to later on in this article. The bulb is cut with a sharp knife, just above the basal plate, deeply enough to cut through two or three scales. These circular scales can then be removed, and each one cut longitudinally into five or six segments. Each segment now resembles a scale from a lily bulb. These segments are then dusted with a fungicidal dust, and planted in sand or on sand and covered with spaghnum moss. So far as possible, maintain a temperature of 70 degrees Fahrenheit until the bulblets have formed at the base of segment. The temperatures may then be lowered, and the segments planted out in autumn. The bulblets will develop foliage leaves in spring, and should be dug in summer when these have died down.

The parent bulb should have the cut surfaces dusted with a fungicide such as Thiram, and be stored in dry conditions. These may be replanted as normal in autumn, and will bloom in spring. The chief advantage of this method is that the parent bulb is not destroyed, an important point with new hybrids or other rare varieties.

LILIUM

One of the most effective methods of propagating lilies is by scaling. The bulb consists of a number of loose scales joined on to a basal disc, and these scales have the potential ability to produce new bulbs. The bulbs are dug as soon as the stem has died down, and the outer scales carefully removed, usually by breaking them off, taking care to break them down near the junction with the basal disc.

These scales are then dipped into a fungicide dust so that the broken end is protected against invasion by fungus diseases. Good results can be obtained by using a combined hormone and fungicide dust of the types now available on the market. The scales can then be laid on a tray containing an inch of sand, and covered over with damp moss. Scales may also be planted in sand but recent results indicate that best results are obtained when moss is used. Possibly the better aeration under moss is responsible for the increased bulblet formation.

If the scales can now be kept in temperatures around 70 degrees Fahrenheit, bulblet formation will be rapid. A heated glasshouse is ideal for this purpose, but an enthusiast has had good results by storing the scale in polythene bags in a cupboard by the hot water cylinder in his house. As soon as the bulblets have started to form roots, they can be exposed to lower temperatures. L. Longiflorum types may be planted without cold treatment but L. Auratum and L. Speciosum will not make foliage growth until they have received such treatment. If the scales and bulblets are not planted out until spring no foliage will appear until the following spring. If the scales can be stored in a cold place, at temperatures of about 40-45 degrees Fahrenheit, for several weeks before planting, they will form foliage leaves in the first year.

The scales should be planted about two inches deep, and the young bulbs should be dug after the first year and replanted somewhat deeper in order to encourage stem rooting.

Most of the stem rooting bulbs can also be propagated by bulbs which can be induced to form on the flower stem. In this method the flower stems are pulled out from the bulbs at the time when the flower stem is starting to die down. These stems are heeled in on a slant, so that about half the length of the stem is covered and the base of the stem is about three or four inches below ground. Bulbs form on the base of the stem during winter and many of these will form foliage leaves above ground the next spring. This method is simpler than scaling, but the yield of bulbs is lower than that secured by scaling, so that the latter method is the one most commonly used commercially.

Some species of lilies, notably L. Longiflorum, can be propagated by leaf cuttings. These leaf cuttings are made usually just after flowering, while the leaves are still green. Each leaf has a small piece of the stem attached, and is planted in sand so that the stem piece and the base of the leaf are covered. The sand should be kept moist but not saturated. Bulbs form at the base in about four to six weeks and may be treated from then on as for scales.

LACHENALIA

Lachenalias increase fairly rapidly by natural division, but are also propagated by leaf cuttings. The leaves are pulled from the bulbs at flowering time, and may be planted intact, or may be cut into several pieces. These are then dipped into a fungicide to protect the wounded areas, and planted into moist sand. The sand must be kept moist and new bulbs form in a few weeks. Various other bulbs can be propagated in this way, including Musari, Haemanthus, and Hyacinths, and possibly others. In these cases the entire leaf should be used as a cutting, but in all other respects they should be treated as for Lachenalia.

AMARYLLIS

These bulbs form small offsets around the base of the mother bulb, but the rate of offset formation may be hastened by a process known in U.S.A. as reaming. The reaming is done by cutting out and removing the centre of the base of the bulb to a depth of about an inch, leaving a fringe of roots around the outside. The bulb is then dusted with a fungicide and replanted. By the end of the first season the bulb may be expected to have produced many offsets which may be removed after another season's growth.

NERINES

The many hybrid Nerines now being introduced can only be satisfactorily increased by vegetative means. Some of these have been propagated by means of leaf cuttings, and others by scale segments in the manner indicated for Hyacinths. As far as can be determined at present there is a difference in reaction between the various hybrids, and this would indicate that there are variations in technique required. One method worth investigation is scale segments treated with root inducing hormones.

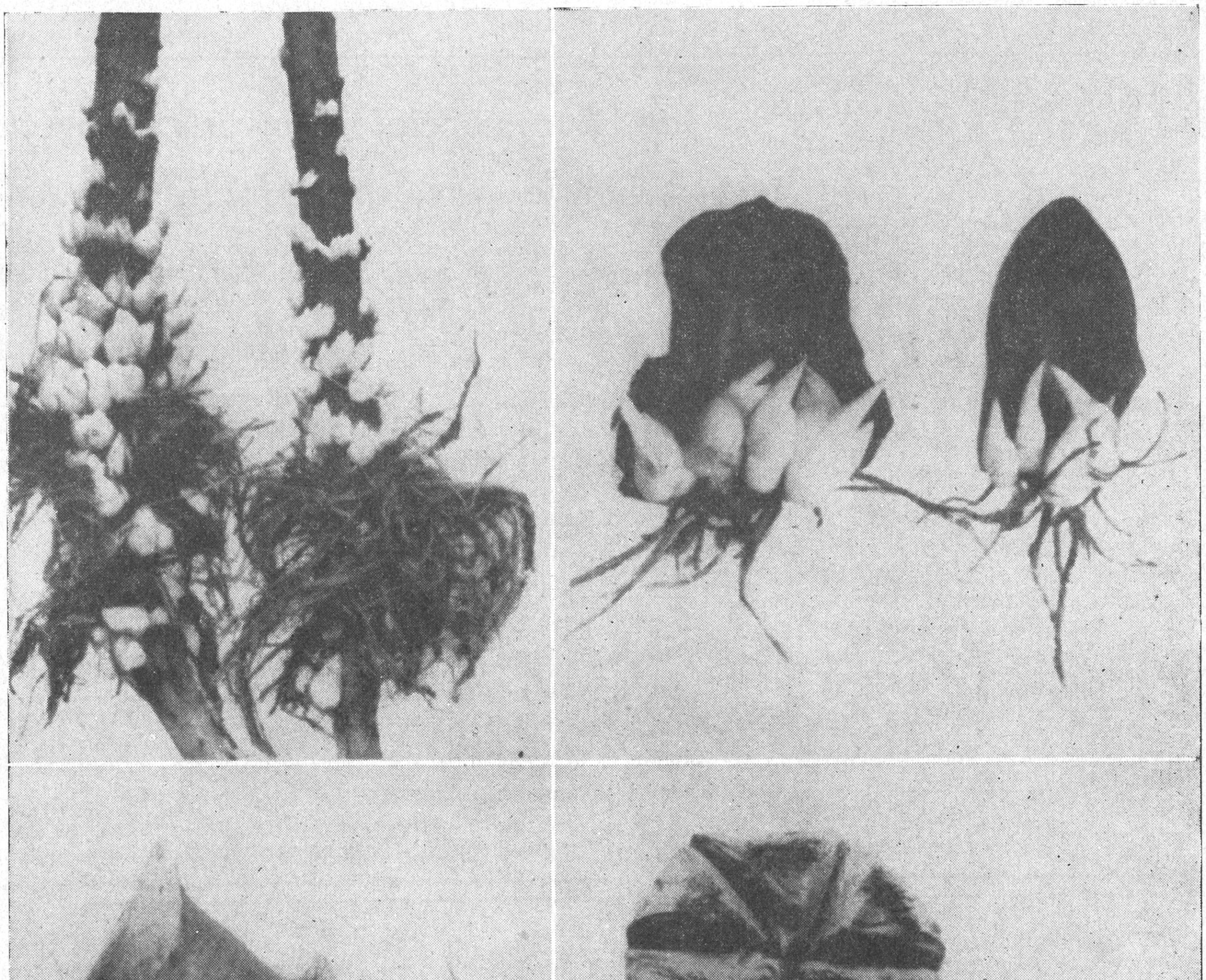
Loder Cup Award

This year the Loder Cup was awarded to Mr. M. C. Gudex, M.A., M.Sc., N.D.H. (N.Z.), A.H.R.I.H. (N.Z) All members of the Institute will join in congratulating Mr. Gudex on his well merited award.

About 250 people were present at a ceremony in the Hamilton Boys' High School Assembly Hall when the Minister of Agriculture presented the cup to Mr. Gudex. Among other visitors were the President of the Institute, and Mr. A. M. W. Greig, Director of the Horticulture Division.

Mr. Holyoake, in making the presentation, reminded the audience that the Loder Cup could be presented to any local body, company, group of persons, or person who had done much to foster the love of native flora. It had already been presented 25 times, he said, but this was the first time it had come to the Waikato. "Mr. Gudex is one of those rare individuals who can interest, excite, and enthrall others in his subject," he said.

Mr. Gudex, in thanking Mr. Holyoake and the Institute, appealed to the younger generation to protect the native bush. He made reference to the 12½ acres of native bush at Claudelands, and appealed for its preservation.



Top Left: Bulblets forming on the stem of a lily which had been "heeled in". —Photo courtesy U.S. Dept. Agriculture.
Top Right: Detached lily bulb scales showing development of bulblets.
Lower Left: Natural increase of bulbs, Dutch Iris.
Lower Right: Cross cutting of hyacinth bulbs. The bulb at the bottom has developed new bulblets in the centre.

Nursery Stock Research

IN May, 1955, a committee representing interested bodies was set up under the title of the Nursery Stock Research and Extension Committee. The committee, which is under the chairmanship of Mr. A. M. W. Greig, consists of three representatives of the Horticultural Trades Association, three from the Hoticulture Division, Department of Agriculture, and one each from Plant Diseases Division, D.S.I.R., and Massey and Lincoln Colleges. The committee meets four times each year, to discuss and advise on problems associated with the nursery business. Matters discussed may sometimes have useful application to problems affecting home gardeners, and it has been decided to make advice on such matters available to this publication. We print below reports on these matters.

DOWNY MILDEW ON ANTIRRHINUM SEEDLINGS

This disease has been responsible for serious losses among antirrhinum seedlings in New Zealand, both in the nursery stage and after planting out. Trials in New Zealand have shown that dusting the seed with 50 per cent. Thiram (tetramethyl-thiuram-disulphite) gave good initial control of the disease, and subsequent dusting of the seedlings with a 10 per cent. dust of Thiram at 10-day intervals gave good control of the disease where it occurs on established plants.

ANTIRRHINUM RUST

This disease has been of some serious consequence in New Zealand in recent years. Trials with allegedly resistant varieties gave varying response. In response to an inquiry, Dr. Kenneth Baker, of the University of California, stated that rust of antirrhinums had been prevalent in California for so long that horticulturists there had developed methods of combating rust, and had found this more satisfactory than attempting to breed resistant varieties. The disease can infect the plants at temperatures between 45 degree and 65 degrees Fahrenheit if the plants remain moist for 6 to 8 hours, so that infection can occur in most parts of New Zealand during the year. After infection, the disease spreads most rapidly at 70 degrees to 75 degrees Fahrenheit and is worse in dry seasons than in moist seasons.

Spraying with Dithane Z.78 (Zineb) at the rate of 2 lbs. per 100 gallons (1¼ ounces to 4 gallons) gives good control of rust if the spray is applied so as to wet the underside of the leaves. Spraying should be repeated at 7-day intervals to ensure complete control.

APHIDS ON ROSES

There has been some discussion on this subject from time to time in New Zealand. Plant Diseases Division, D.S.I.R., reports: "As an aphicide Lindane emulsion gave excellent control with no damage when applied twice at four-week intervals. The Lindane was included with fungicides on a black spot trial during 1954-55."

DIE BACK ON ROSES

Mr. Hunter, of Plant Diseases Division, D.S.I.R., has prepared the following report on this subject:—

DIEBACK AND CANKER OF THE ROSE

Considerable confusion exists regarding the factors responsible for the diseased conditions known as dieback and canker on roses. The literature of other countries on the subject is rather perplexing and little precise information is available which would help in identifying the various types of dieback and canker occurring in New Zealand. This account is an attempt to deal with the problem as met with in the field in this country. Dieback of a shoot may follow the establishment of a canker, but can also be the result of other agencies, so that the two conditions, although often associated, should be regarded as distinct.

TERMS DEFINED

(a) **Dieback**

Among nurserymen and rosarians the term dieback is used to describe the death of part or the whole of a shoot of the current year's wood, or the terminal portion of more mature wood which may have been pruned. The discoloration associated with the death of the tissues and the method of its spread depends on the agency responsible. Dieback is often halted at a node, but may continue past this natural barrier and cause the death of part or the whole of the infected cane. Dieback of stems may be caused by:—

(1) The failure of a wound to form a barrier and the consequent invasion by a pathogen into the plant tissue.

(2) The formation of cankers further down the stem, encircling it, and resulting in the death of the apex of the shoot.

(3) Adverse environmental conditions.

(4) Injury.

(b) **Canker**

A canker is a well marked but limited area on the outer layer or cortex of the steam. It may be superficial or extend to the wood, vary in size and shape and may have a coloured or raised margin. Its formation can usually be ascribed to the presence of a pathogenic organism.

For the purposes of this account, the causes of dieback and canker may be grouped and dealt with under the following headings:—

1. PATHOGENIC ORGANISMS

Up to the present the organisms associated with dieback and canker on roses in New Zealand are Pseudomonas syringae, Botrytis cinerea, Leptosphaeria coniothyrium, Diaporthe eres and Verticillium dahliae.

Pseudomonas syringae. This bacterial disease commonly known as Blast has caused considerable loss to rose growers in this country. During cold, wet spring weather young shoots of established plants, or maiden growths from buds inserted the previous summer, are especially liable to infection. The top of the infected shoot shrivels and turns black, curling downwards in a characteristic manner, and if infection takes place early while tissues are soft, the entire shoot may be destroyed. Later when some lignification has taken place and on the approach of drier and warmer weather the apex only may be involved, the woody tissue towards the base being capable of some resistance. Wounds and injuries to the bark so small as not to be visible to the naked eye can form points of entry, leading to the formation of depressed dark brown to black longitudinal cankers which are capable of causing extensive dieback. Temperatures in the vicinity of 60 degrees Fahrenheit accompanied by wet weather favour rapid spread.. It has been proved that, during the growing season, Streptomycin used at a concentration of 100 p.p.m. gives better control than any therapeutant at present available. During dormancy Bordeaux at 10-8-100 affords protection against infection and spread.

Botrytis cinerea. Where roses are being grown under poor conditions, either as to position or cultural procedure, this fungus is often associated with dieback on young stems. The parasite can gain entry either through dead tissue on snags left when cutting blooms or through injuries on the stem. Under favourable conditions a characteristic buff coloured lesion is formed around the point of infection. Should conditions continue to be favourable for the fungus a pale grey mould will develop over the infected area. When it is found necessary to use a therapeutant for control, one of the Carbamates is recommended and Thiram at the concentration of 2 lbs. active ingredient per 100 gallons has given satisfactory control.

Leptosphaeria coniothyrium. This fungus can attack young wood but may also be found on rose stocks especially around the point of bud insertion during propagation. On the young wood cankers become established around broken thorns, at leaf scars, or at other injuries to the stem. The cankers formed are not constant as to size or appearance but usually start as reddish spots on the bark, increasing in size to form necrotic areas, which with age extend to brown patches with a darker margin. Sometimes cankers can be more extensive, being over an inch in length and may completely encircle the stem, inducing dieback of that portion of the shoot above the "ringed" area. The symptoms can be distinguished from those caused by Blast and other forms of canker by the light grey appearance of the bark which is often associated with infection.

When established on rose stocks during the operation of budding a reduced "take" may result, or there may be early death of the maiden shoot, or poor unions which cause maiden shoots to be easily displaced, may be the consequence.

As a general means of control cutting out shoots which show cankers affords protection by eliminating the means of spore formation. Care should be taken to cut to a bud on healthy wood well below the seat of infection and to destroy the diseased material by fire. Some protection of the wood during the dormant season can be achieved by using a 10-8-100 Bordeaux as recommended for Blast, and nurserymen are advised to dip their plants in this fungicide when lifting from the field and again prior to dispatch, if the bushes have been "heeled in" for some time before being consigned to the purchaser.

Diaporthe eres. This typical wound parasite attacks a wide rang of host plants and has been found on the stems of the rose in this country, especially on plants making weak growth. It gains entry through injuries to the stem caused by thorns or other means which break the protecting bark, and also through tissues exposed as the result of pruning cuts. Brown cankers are formed as a result of infection. If the plant is in active growth, there may be produced a protecting wound callus, which arrests the further progress of the pathogen. If entry is gained when the plant is practically dormant, or at a time when it is making weak growth, no wound callus barrier is formed and the dieback may be extensive.

Control measures are similar to those recommended for Leptosphaeria.

Verticillium dahliae. The young growth of roses, during periods of high temperature in summer, may wilt and develop dieback as a result of invasion by this organism, which is a soil inhabiting fungus gaining entry to the plant through young uninjured roots. Passing ultimately into the conducting vessels of the stem, its presence is often associated with a substance which causes a characteristic brownish discoloration, a condition used as a diagnostic symptom indicating the existence of the fungus within the plant.

Infected plants are not usually killed outright the first season, but often recover on the approach of cooler weather. However, as the plants get weaker each year, should the presence of the fungus be confirmed in a suspected plant it is best to destroy by fire, removing at the same time the soil in the immediate vicinity. Treat the soil around nearby bushes with copper oxychloride at the rate of one pound per five square yards, applied dry and watered in.

Land known to be infected should be avoided if possible when planting roses. If, however, it is necessary to replant on the same area, the soil can be treated with copper oxychloride as above, or soaked with a 2 per cent. solution of formalin, using at least four gallons of the solution per square yard. Care should be taken that the drenching solution penetrates and soaks the soil thoroughly. It must not be used near living plants.

Some time should elapse before replanting after treatment, it being generally agreed that three weeks is sufficient when the material is used in the open, and providing the soil is reasonably warm at time of application.

2. UNSUITABLE ENVIRONMENT

The rose is a plant of temperate climates, so that prolonged periods of excessively high temperatures, especially if associated with drought, reduces its vigour and predisposes it to dieback. Shallow planting, especially on hot dry soils, induces dieback and may be a combined temperature and drought effect.

Conversely, water-logged soil will destroy roots and this inevitably is responsible for the death of shoots.

Exposure of the bark of newly planted standard roses to excessively strong sunshine may result in sun scald, which causes dieback. Protection of the stem by brown paper for the first season has been advocated and is a wise precaution when growing in a district where strong sunshine may be expected.

The adverse effect of high wind could be included under environment, but is here discussed under injury.

3. INJURY

Exposure to high wind, with the resulting lashing about of canes, causes mechanical injury and dieback while under those conditions. Friction of adjoining branches and the action of thorns damages the epidermis and provides a means of entrance for the spores of pathogenic fungi.

Careless handling of plants at lifting time causes serious dieback. During the period between lifting and planting it is essential to avoid excessive drying of roots, especially by exposure to sun or wind. Also if the bark is allowed to become shrivelled during this critical period, dieback of canes and often death of the plant may be the result.

Dieback is associated with pruning cuts, especially with some soft-wooded modern varieties and under cultural conditions which tend to produce sappy wood. This type of growth is difficult to prune without injury, especially when secateurs are used for the operation, as the squeezing action invariably injures the portion of the shoot left on the plant.

In discussing the association between pruning cuts and dieback it should be recognized that the rose, although a woody perennial, does not readily develop protective callus as a response to wounding. In the majority of cases, especially with some modern varieties, pruning cuts made in July will, a year later, show no apparent protection from callus formation. Multiflora cuttings inserted in the field as stocks can make ample growth and later be budded, and still show no healing callus formation to protect the original apical cut when headed-back to the bud in spring.

This fact stresses the importance of avoiding injury to rose shoots as far as is practicable, also for the necessity of careful and efficient pruning so that clean sharp cuts are made and no snag left above the selected bud.

Plants injured through excessive defoliation following severe Black Spot infection often show a considerable amount of dieback on young stems, especially with varieties belonging or related to the Pernetiana group.

In conclusion, it could be stated that apart from the application of therapeutants where they become necessary, care by nurserymen that only disease-free bushes are distributed is important. This must, of course, be accompanied by the provision of the correct environmental and cultural requirements of his plants by the purchasing rose grower, and the understanding of the importance of sanitation in the elimination of sources of infection.

1957 CONFERENCE

ACCOMMODATION ARRANGEMENTS

Would intending Delegates and visitors to the 1957 Conference and National Flower Show make accommodation arrangements by December by advising Mr. K. Haslett, Government Tourist Agent, Cameron Street, Whangarei, of requirements.

Plastics for Plant Houses

M. Richards, B.Sc.Hort. (Notts.), N.D.H., N.D.H.(N.Z.)

"Be not the first by whom the new are tried
Nor yet the last to lay the old aside."
—Alexander Pope.

SINCE the very early days of the cultivation of plants, the need for protecting plants from the undesirable effects of the climate has been recognised. By modern concepts, some of these were crude in the extreme, but when we recognise the paucity of material available for this purpose, the ancients did very well.

For many years, the most effective protection against cold was the walled garden. Tender plants, placed close against the wall, received protection from the freezing winds, and also received the benefit of radiation from the wall following sunny days. Later on, the wall was often capped with a verandah-like projection, and inside this braziers were often used to protect the plants. The introduction of glass as a window material made possible the building of the "orangery," a room with large windows (by eighteenth century standards), in which potted citrus trees could be sheltered over winter. It was not until Joseph Paxton, gardener to the Duke of Bedford, conceived the use of a glass roof that the glasshouse as we know it was born.

At first glance one might claim that we have progressed far since those days, yet a close investigation of the modern glasshouse reveals deficiencies that have existed since the days that Joseph (later Sir Joseph) Paxton built his first structure. True, we have improved light penetration into the house, by using larger sheets of glass and smaller structural members, we have improved ventilation to some extent by redesigning the ventilators, and we have certainly improved the heating arrangements to maintain high night and day temperatures. Yet we still do not have the climate of glasshouse truly under control, and although we have evolved methods of growing plants reasonably well in such structures, these methods are usually a compromise to cope with the difficulties encountered in glasshouse conditions.

The main faults with glass as a glazing material are:—

1. The weight of glass necessitates fairly heavy structural members which in turn reduce the light entering the house.
2. It is expensive and brittle, so that both initial cost and maintenance costs are high.
3. The joints between the glass cannot be made airtight, so that there is a constant interchange of air between inside and outside the house.
4. While glass transmits a considerable quantity of light, it does cut out a considerable quantity of light of the type we know as ultra-violet, and this has a considerable effect on plant growth. The "drawing" of plants in glasshouses is very largely due to the shutting out of this type of light.

So long as we must use glass as a glazing material, it seems inevitable that we must accept these limitations upon our glasshouses.

During the last decade there has been much interest in plastic materials as substitutes for glass in "plant-house'" construction, largely because they could be moulded in large sheets without being as brittle as glass. Possibly the important of these was the plastic which we know as perspex, and some experience with this material nearly disposed of plastics for all time. Beside the cost factor with perspex, light transmission is inferior to glass, and plant growth is unsatisfactory.

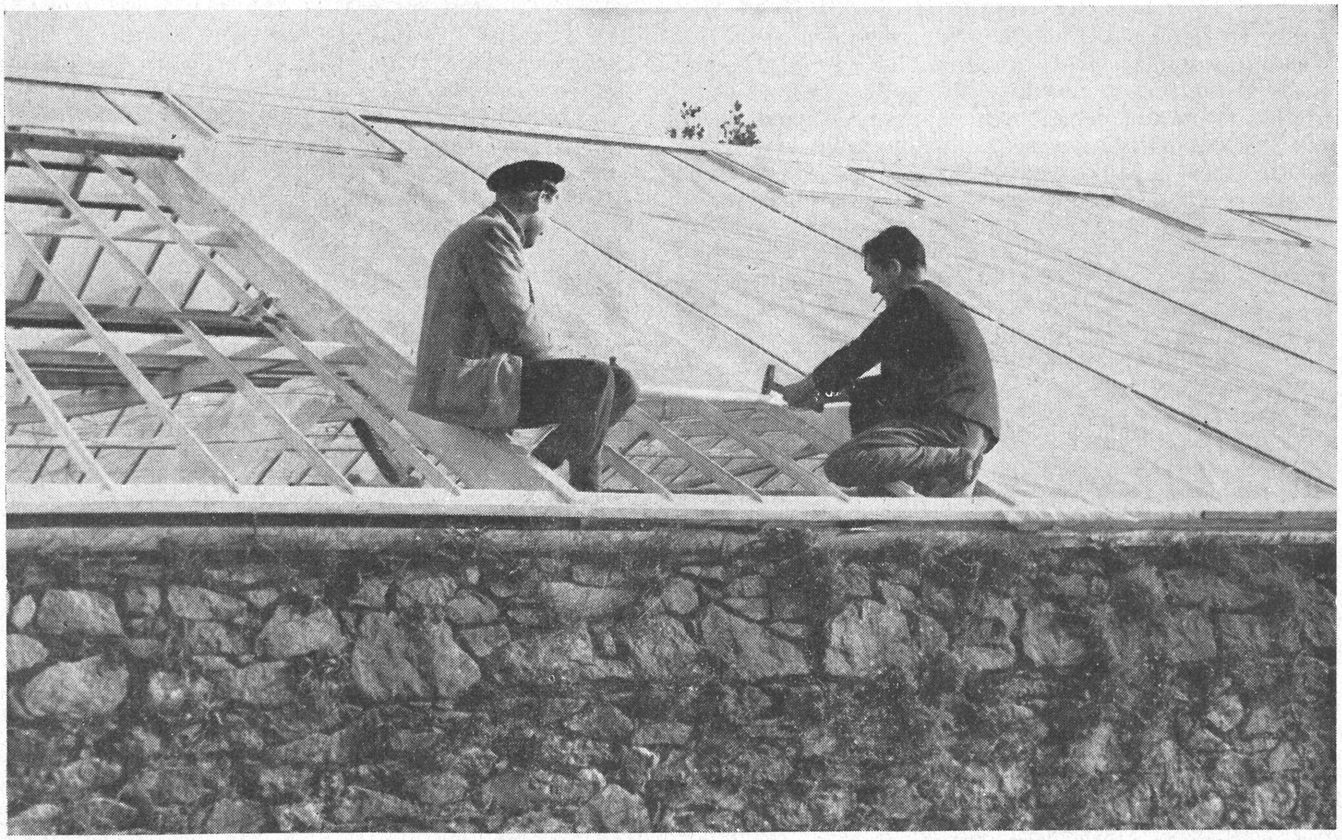
In recent times there has been a resurgence of interest in plastic materials for glasshouse construction. This interest has extended in two directions. One is the use of the plastic as a material with which the plant house may be covered. The other is the use of the material as a method of insulating existing glasshouses. For this purpose the manufacturers have evolved a special grade of transparent polythene which can be made in large sheets. This material has very good light transmission qualities when made in thin sheets. For example, it will transmit about 95 per cent. of the visible light transmitted by glass, but whereas glass transmits practically no ultra-violet light, the polythene transmits over 50 per cent. of the available short wave length light of this type. Unfortunately, this light transmission decreases as the thickness of the plastic increases, so that for plant house construction only relatively thin plastic can be used.

Because the material is pliable, and can be cut easily with ordinary household scissors, it can be used easily to cover any shaped structure, which may be an important feature in plant house construction in the future. Furthermore, the material is easily attached to the wooden glazing bars by means of tacks or staples of the type used for paper fasteners. To assist in securing the material, a thin wooden batten is usually attached over the joins in the plastic.

So far we have little experience with this material in New Zealand, but glasshouses have been glazed in this way both in Britain and in the Channel Islands. In the latter case the plastic was still in good condition after a year, and had withstood heavy winds. The plastic used in this instance was .005-inch thick. On a house in England where a thinner grade of plastic, .002 inches thick, was used, the plastic was good after six months. Polythene breaks down gradually under the influence of light, and it is expected that the thinner material may only have a relatively short life. Some experience will be necessary to determine the best grade to use. This will, of course, be influenced by the crop being grown. For example, for tomatoes, where protection is needed only for six months, it may be most economical to use the thinner material which costs approximately one penny per square foot, and renew the material each year. For crops requiring continuous covering, the thicker grade which will cost approximately threepence per square foot may be most economical.

What of the plants grown under polythene? It has been publicly stated in New Zealand that this material is unsuitable as a plant cover, the insinuation being that plants do not grow satisfactorily under it. Experience does not support this contention, except that plants under plastic may not grow so lush as plants under glass. If lush soft growth is required, and personally I can see very little justification for this, then do not use plastic.. Trials in Belgium have shown some remarkable results with lettuce grown under polythene compared with similar plants grown under glass. The plants covered with plastic had a higher dry matter content than had plants under glass, and, more important from the vegetable growers' point of view, a much higher vitamin content than plants grown under glass. In other words, plants under plastic have shown much more the characteristics of plants grown without cover.

This fact may yet prove to have very important and far-reaching effects upon the "glasshouse" industry. Negotiations to have this research carried out overseas are already under way, it being unlikely that such research will ever be carried out in this country. It is too early as yet to predict what results will be achieved, but there is a possibility that plastics may eventually remove certain troubles which occur in glasshouses!



Covering the frame of a glasshouse in Gurnsey with five feet wide plastic. The plastic is being secured to the glazing bars with paper-taples and a batten is applied to each joint.

—Photo courtesy Dyes & Chemicals Ltd.

The use of the thinner plastic film for glasshouse insulation is already much further advanced. The film of plastic is attached to the inside of the sash bars to form a "second skin" inside the house. This acts as an insulator in two ways. Firstly it traps a layer of air between the two "skins" and this layer of air acts as an efficient insulator. Secondly it cuts down the rate of exchange of air between inside and outside. This principle of double glazing is well established in countries with cold winters, but for glasshouse construction it is a difficult and expensive process where both "skins" are of glass. The degree of insulation is quite remarkable in heated glasshouses, giving temperatures as much as 10 degrees Fahrenheit higher than those occurring in similar non-insulated houses. This means that higher temperatures can be maintained with existing heating plants, or the same temperature can be maintained with less fuel. Calculations have shown that in one house in New Zealand the saving in fuel to maintain 60 degrees Fahrenheit in a house would pay the cost of the plastic in 20 days. From this it can be seen that the plastic insulation can be a very economic proposition.

In the midst of this Utopian outlook it is necessary to sound a note of caution. Our existing methods of glasshouse management have been evolved to meet the conditions encountered in a conventional plant house. Sufficient has already been said to indicate that conditions in a plastic covered house will be quite different. One of the most important differences is the reduced rate of air exchange between inside and outside. While this is undesirable at times, especially at night time in colder seasons, it is necessary to provide actively growing plants with fresh air. If this is not done, the plants may be deprived of sufficient carbon dioxide to continue growth. To provide sufficient carbon dioxide, especially for crops such as tomatoes, it will generally be necessary to open the ventilators on days when little or no ventilation would be given in a normal glasshouse. In fact, some ventilation will be desirable for most crops throughout all daylight hours.

Again, because the air in the plastic house is not being changed regularly, the atmosphere becomes rather more humid than in a conventional glasshouse. This may be quite acceptable for some crops, but may be disastrous for other crops such as tomatoes. For this reason also more ventilation may be necessary in plastic or plastic lined houses than in conventional houses. If plastic houses become more acceptable than conventional glasshouses it may become desirable to utilise other methods of ventilation, rather more an air-conditioning than a ventilation. Such techniques are impracticable in existing glasshouses. The air-tightness of the plastic structure may yet prove to be a blessing in disguise, in that it may allow us to develop a plant house in which the environment can be closely controlled.

In concluding this article I would like to express my appreciation of the information given me initially by Messs. British Visqueen Ltd., manufacturers of polythene materials, their New Zealand agents, Dyes & Chemicals Ltd., and Professor C. Baron, Directeur, Ecole Provinciale d'Horticulture de Grand-Manil, Belgium. Without this basic information, my interest in this subject might never have been stimulated.

Air Layering

M. Richards, B.Sc.Hort. (Notts.), N.D.H., N.D.H.(N.Z.)

IN recent years there has been much interest in air layering, which has been described, somewhat erroneously, as a new method of propagation. As far back as 200 B.C. the Chinese had developed a method of layering plants which was known as pot layering; the French developed a similar method which became known in Europe as "marcotting," but the method has never been popular until recent times.

Basically the method consists of wounding a branch of a tree or shrub, surrounding it with soil or some similar media, and then waiting for roots to develop. It is a "safe" method of propagation, since there is little likelihood of the shoot dying before roots develop, as so commonly happens with cuttings. The Chinese method was to cut a pot in half, and use the two halves to enclose the soil around the branch. This was an ungainly method, and although I have used it, the branch must be staked to support the pot. The French method was to use a leather or similar bag around the compost. This was somewhat simpler but still rather ungainly. Both methods suffered from the same trouble. It is difficult to ensure that the medium stays moist, without fairly constant attention. No doubt this was less of a problem in the days when air layering was a popular method of propagation.

The introduction of polythene plastics ushered in a new era for this method. Here was a material which had the virtues of being light, cheap, and relatively impervious to water. Trials in the U.S.A. demonstrated that this material could be used to surround a medium of moist sphagnum moss, and the plastic would ensure that this moss remained moist over quite a long period. This work was repeated and amplified at the R.H.S. gardens at Wisley and has subsequently been used to a considerable extent in New Zealand.

The method is in itself very simple. An upward cut is made in the stem at the point where the aerial layer is to be applied. This cut should extend for an inch or more, where practicable, and should go about half-way through the stem. This wounded area is then surrounded with damp sphagnum moss. Preferably the moss should be dripping wet and then wrung out to remove excess moisture. This leaves a rooting media which is well aerated.

A tube of polythene plastic is then placed over the sphagnum moss, and tied top and bottom. Alternatively a piece of sheet polythene may be wrapped around the sphagnum, giving plenty of overlap at the joints to ensure that the joint is relatively airtight. This is then tied at the top and the bottom, so that the layer is fully enclosed. Following this one waits for roots to develop. One man who has used this method extensively assures me that he can tell when roots have developed by the drying out of the sphagnum moss. The layer is then severed from its parent and planted in a shady place to continue to develop its root system, and to grow into a plant large enough to be transferred to its permanent place.

SEASON FOR LAYERING

English work suggests that this is best done in early spring, before growth commences. Best results are obtained when the wound is made into one-year-old wood, that is, wood which grew during last summer. Under this treatment most plants form roots during the following early summer, and can be severed during the following autumn.

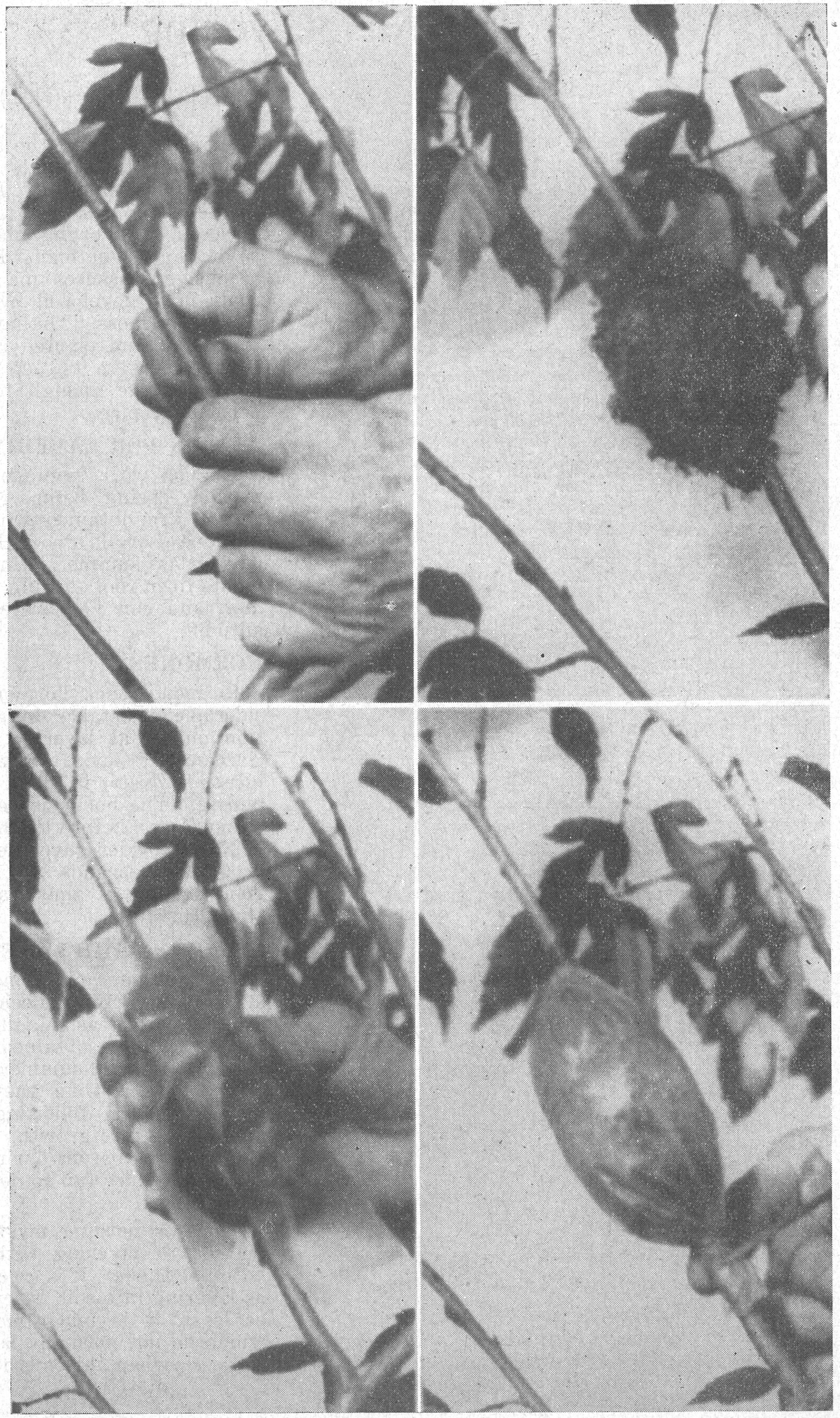
HORMONES

In most cases hormones have been of considerable assistance in stimulating root formation on aerial layers. Hanger, at the R.H.S. Gardens, Wisley, recommended the use of the hormone dusts, in their stronger form for this pupose. The hormone powder is dusted into the cut surfaces, before the moss is applied. Seradix B No. 3 powder gave the best results, but other proprietary brands are likely to give equally good results, if they are applied at equal strengths.

REMOVING THE LAYERS

The layers may be removed at any time if they are rooted. With deciduous plants, however, especially Azaleas, Magnolias, and Acers, better results will be obtained if the layers can be removed by mid-summer. If they are not well rooted by this time, they should be left on the bush until the following spring, just as they are coming into growth. When these layers are cut from the parent during their dormant season they sometimes fail to develop during the following spring.

There is nothing mystical or magical in this method of layering with aerial layers covered with polythene. It is essentially the same method as layering into soil, except that, for the amateur at least, it is much more convenient. Plants which do not normally layer readily are unlikely to do so when this method is used.



THE STEPS IN AIR LAYERING

Top Left: Making a cut in the steam. This is better if it is made sloping upwards, not downwards as in this picture.

Right: Peat moss tied around the wounded area.

Lower Left: Plastic film being wrapped around the moss.

Right: The plastic is tied top and bottom.

—Photo courtesy National Hort. Magazine, U.S.A.

The Temperature Requirements of Bulbs

M. Richards, B.Sc.Hort. (Notts.), N.D.H., N.D.H.(N.Z.)

IN previous articles I have dealt with bulbs in which the flowers are initiated during the storage period. In this concluding article I will deal with bulbs and some corms which do not develop their flowers until after planting. This does not mean that they are not affected by storage temperatures; on the contrary these plants may be greatly affected by storage temperatures.

IRIS

The bulbous Iris shows no sign of flower bud formation when the bulbs are lifted in December and January. Flower buds are not formed until the bulbs are rooted again, and the temperature has fallen to the region of 50 degrees Fahrenheit. This means that these bulbs will flower satisfactorily under practically all conditions encountered in New Zealand. The notable exception to this rule is Iris tingitana, which is noted for its shy flowering habit. Dutch workers have postulated three conditions which must be fulfilled before flowers are initiated in this species.

(a) The bulbs must be of a certain minimum size and weight which will permit flower formation to occur.

(b) These large bulbs must go through a high temperative phase.

(c) The bulb must then go through a low temperature phase, preferably before planting.

Each stage must proceed in the order given before flower formation can proceed. At Massey College we have achieved good results with I. tingitana by using the storage treatments recommended, i.e., 82 degrees Fahrenheit for three weeks, followed by 45 degrees Fahrenheit for three weeks before planting. Following planting the bulbs should be kept cool; this can be done effectively by giving the soil a good watering after planting, and then providing shade or a soil mulch. So far we have not been able to determine the minimum size and weight for flowering sized bulbs, but only the larger sized bulbs should be used for forcing.

Iris tingitana is a native of Algeria and Morocco, and grows at the higher altitudes. Under such conditions it receives very warm soil temperatures, and cold conditions over winter. Often snow lies on these areas for considerable periods, and the bulbs appear and flower in early spring. The areas in New Zealand in which this species flowers are mainly areas in which high soil temperatures are experienced in summer. This is a much more important factor than is generally recognised. Others have achieved success with I. tingitana by placing the bulbs on an iron roof during summer, a crude form of storage, and by burning rubbish over the beds of bulbs. Many growers have "secret" recipes for flowering these bulbs. Every such method which I have investigated has raised the soil temperature during the summer period.

One point should be emphasised: I have never yet found anyone who can achieved 100 per cent. success in flowering these bulbs. We have had consistent results of 60-70 per cent. of bulbs flowering under these storage conditions. Possibly the other 30-40 per cent. of the bulbs are not sufficiently large to flower satisfactorily.

Because of the erratic flowering habits of tingitana, the Dutch growers crossed this with Iris Ziphium,to produce what we know as the Dutch Irises, one of the best-known varieties being Wedgewood. While these will flower satisfactorily without special treatment, the cut flower grower is interested in blooms earlier than those usually produced in gardens. For this purpose bulbs are grown usually under some protection such as a glasshouse frame or in a very warm sheltered locality. To induce early flowering the bulbs are given storage treatments.

For Wedgewood the bulbs are stored at 78 degrees Fahrenheit for three to five weeks immediately after lifting. They should then be stored at 55 degrees Fahrenheit until planting, and should be kept as near as possible to this temperature until the leaves are about 2½ inches high. At this stage the temperature may be raised slightly, but temperatures should not exceed 60 degrees Fahrenheit. Otherwise the flowers may not develop properly.

For Imperiator, temperatures vary. The preheating is as for Wedgewood, but the bulbs should be planted immediately after pre-heating and kept at 44 to 48 degrees Fahrenheit until the bulbs are 2½ inches high. At this stage temperatures may be raised to 60 degrees Fahrenheit.

RETARDED BULBS

The Dutch growers have evolved a technique of retarding Iris bulbs for shipment to the Southern Hemisphere. The bulbs are first given a treatment at 78 degrees Fahrenheit until they are to be shipped. Bulbs have been stored at this temperature for up to 12 months, without showing any signs of growth. This treatment may offer a method of producing Iris blooms other than those occurring naturally.

LILIUM

For garden use Lilium form flower buds and develop flowers without any special temperature requirements. Overseas L. longiflorum and its hybrid varieties are often forced under glass to provide florists' flowers. If the bulbs are stored in polythene lined boxes at 40 degrees Fahrenheit to 50 degrees Fahrenheit for five to six weeks immediately after lifting, blossoming is hastened very considerably. Lower temperatures or longer storage periods reduce the number of flowers formed. Long storage to provide very late blossom is accomplished by storage at 31 degrees Fahrenheit and planting at intervals. After four months at this temperature storage, the average days to blossoming is 100. After nine months' storage the period is reduced to about 70 days. These times should be regarded only as a guide, as they will vary considerably with the conditions after planting.

FREESIAS

In New Zealand early freesias are generally raised from seed each year, it being generally held that these bulbs cannot be forced. In other countries, especially Europe, forcing of the bulbs is much more common than raising of seedlings, although the latter method has gained prominence in recent years.

Forcing is accomplished by heating the bulbs to 82 degrees Fahrenheit for 13 weeks, followed by three weeks at 40 degrees Fahrenheit. Bulbs are then planted and kept cool, under 55 degrees Fahrenheit, until the leaves are four or five inches high. The boxes of bulbs are then brought into the glasshouse and the temperature raised to 60 degrees Fahrenheit. While this method does not give blossom as early as is possible with seed, it does provide a useful method of securing early flowers from varieties which cannot be raised from seed.

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