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CONTENTS

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PROPAGATION OF PLANTS BY SEEDS

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Raising plants from seeds is the commonest, least expensive and most suitable for the majority of plants, whether they be short or long-lived, herbaceous or woody. It is the natural method, and plants raised from seed are frequently stronger and more vigorous than those raised by vegetative methods. This, no doubt, is due to the presence of a strong and complete root stock, and to the fact that the plant is completely rejuvenated.

Plants raised from seed usually resemble their parents, but it is an unsatisfactory method for raising seedlings from hybrids, as the resultant seedlings are likely to be varied in appearance. Such plants are usually raised by vegetative methods, i.e., cuttings, layering, grafting or budding.

Factors Controlling Germination

The three main factors are Water, Free Oxygen, and Warmth, but the following also affect germination: Viability of seed, age of the seed, stage of maturity at which the seed was harvested, and the conditions under which the seed is stored. Good storage of seed requires the placing of the seed in airtight containers and placing these in a cool and darkened position.

Of the three principal factors affecting germination water has the most influence. Maintaining the seed compost at an even moisture content is important, as too little or too much will adversely affect germination. Temperature influences germination less than moisture, although once seeds have been sown, excessive temperatures (either too hot or too cold) must not be experienced. Dry seeds are able to withstand successfully extremes of temperature.

The time of sowing, as well as the depth of sowing, influences germination. Deep planting in winter and shallow planting in summer may result in the death of the seeds from the same cause—unsuitable temperatures. Whenever possible, the optimum temperature for the seeds should be aimed at, that is, the most suitable temperature for the germination of the seeds for a particular species. This is usually much higher for tropical plants, such as Zinnias, Marigolds, Maize and Marrows, than for temperate and alpine plants, such as Primulas, Pansies, Violas, Peas and Carrots. Any friable well-worked compost should be sufficiently aerated to permit germination to take place.

Shading of the Seed Bed

As light frequently inhibits the germination of seeds, shading is necessary. This can be effected in the case of seeds sown under glass by a sheet of newspaper, or a pane of frosted glass, while for those sown in the open, shading can consist of scrim blinds, manuka or lattice work. Shading also assists in maintaining an even moisture content of the seed bed.

Aids to the Germination of Seeds

While the majority of seeds will germinate readily if sown under suitable conditions, certain plants possess seeds which require assistance to germinate. Well-known examples are " hard " seeds of Lupins and Clovers, while seeds of Sweet Peas, Acacias, Beet, Eucalyptus, and of some of the trees, will germinate more readily if they are treated before sowing. Treatment is varied, ranging from filing or sandpapering in the case of hard seeds, of Sweet Peas and other hard-seeded Legumes, to soaking in water or a weak solution of sulphuric acid in the case of Beet. Acacia seed may be soaked in commercial strength of sulphuric acid for periods up to ten minutes, without being harmed. An easier method with this seed is to place the seed in boiling water and allow it to remain in the water until it is cold. Seed must be sown immediately after the treatment is completed, otherwise poor germination may result. Eucalyptus seed germinates readily if the seed is sown either in " flats" or in an open bed, lightly covered with soil, and given a light watering. The area is then covered with about two inches of hay or similar material, which is then fired. With seeds such as oaks the seed is stratified by mixing the seed with sufficient sand to cover the seed. The whole is then placed in a box, covered with bags to prevent the sand from drying out or washing away, and the box placed on the south side of a building. In early spring, before germination has commenced, the seed and sand is sown in drills, at a depth according to the needs of the particular species.

Seed Composts

The following are considered by Lawrence and Newell (see " Seed and Potting Composts," by W. J. C. Lawrence and J. Newell), as the principal qualities required for a good seed compost.

1. Good physical conditions. This includes a crumbly structure that permits the free entry of air, and is able to hold sufficient moisture, while permitting excess to drain away.

2. Provision of adequate and balanced food for all stages of the growth of the seedlings.

The above authors consider that all seed soil should have 1½ozs. of superphosphate and ¾oz. of lime added to each bushel (apple box) of soil, or to every square yard of surface, before the seed is sown.

3. Seed compost must be free from harmful organisms.

4. The compost must be uniform in quality, and should the addition of any material be necessary, e.g., leaf mould, sand, such materials must be easy to procure and reasonably cheap.

5. Animal manure is not recommended for seed compost. It has been shown that where this material is used, the introduction of weed seeds and other harmful organisms is possible. If it is desired to cover the seed with some similar material, then the use of well decayed compost is to be preferred.

After many experiments these authors recommend the use of the following compost for sowing seeds in beds or under glass.

Two parts by bulk good medium turf or loam.
One part by bulk peat or partly decayed leaf mould.
One part by bulk coarse water washed quartz or river sand.

To this compost should be added superphosphate and lime in the quantities mentioned above.

Position of the Seed Bed:

The seed bed should be well drained and in a sunny position sheltered from wind.

To facilitate weeding, sowing and watering, seed beds should not be greater than three feet in width.

Seed Sowing in the Open:

Hardy plants (such as annuals, biennials, perennials, bulbs, trees and shrubs).

Most of these seeds can be sown in the autumn, although some can be sown in both the autumn and spring. The seed bed should be prepared, the soil being open and porous. Heavy soils will need the addition of sand or some other material. Raising the level of the bed will ensure adequate drainage. The initial preparation should consist of turning over the soil to a depth of six to eight inches, at least two weeks prior to seed sowing. If this is carried out immediately before the seed is sown, insufficient time will elapse for the ground to settle. Following this digging, the soil should receive several workings, limited to the top two or three inches.

The seed can be sown either in rows, or broadcast over the surface. The seed must be sown evenly and thinly to allow space for the seedlings to develop. The soil must not be wet, but sufficiently moist to enable it to be worked. With the exception of fine seeds, which are sown on the surface, and covered with a very light sprinkling of compost, most seeds are sown at depths from one to four times their diameters. When in doubt shallow sowing is to be preferred to deep.

After sowing, the seed should be covered with a compost similar to that of the seed bed. A compost distinct from the seed bed may separate from the underlying soil allowing the seed to dry out, and causing death to the germinating seed. After covering the seed, the bed should be carefully watered through a fine spray or rose. The bed is then covered with a blind or some other form of covering, which is gradually removed when the seedlings appear.

Subsequent to germination, the seedlings should receive all the light and air possible. No attempt should be made to force them, either with the use of glass, or manures. Weeds must be removed, and cultivation between the rows carried out. Watering should be thorough, through a fine spray or rose, and should be done only when required. Alternate flooding and drying of the seed bed is harmful. A watch should always be kept for the appearance of insect pests or diseases, and remedial measures applied immediately.

Protection against "damping off" can be obtained by the use of "Cheshunt Compound."

Transplanting:

With the exception of seedlings of perennials, trees and shrubs, transplanting should be carried out as soon as the plants are large enough to be moved. Allowing the plants to remain in the seed beds too long will not produce strong healthy plants. Also extensive damage to the roots of such plants will not permit them to recover as easily as plants which have been moved at the correct time.

The following points should be noted:—

1. Allow the plants to become properly hardened before they are transplanted.

2. Choose a cool, and preferably calm day, with little or no sun. If the weather is hot, then transplant the seedlings as late in the afternoon as is convenient.

3. Water the plants some hours before moving them. A thorough soaking will be necessary, but it is not necessary to have mud clinging to the roots.

4. Avoid damaging the roots when lifting the seedlings by using a fork rather than a trowel.

5. Water the soil before setting out the plants. Always water after transplanting.

6. Firm the soil around the roots, making sure that no air pockets exist. Plant the same depth the seedlings were in the seed bed.

7. Do not plant out weak or diseased plants, even if you have insufficient seedlings to complete the job. Infected plants may infect others.

Spring or Autumn Sowing of Hardy Plants:

Most seeds of hardy trees, shrubs, perennials and bulbs appear to be benefited by a period of low, but not necessarily freezing temperatures subsequent to ripening. This treatment aids germination. Temperature requirements for a number of species have now been determined (vide Kains & McQuesten "Propagation of Plants"), but for the majority, temperatures ranging from 35-50° F. appear to be the most suitable. In actual practice sowing seeds when mature, and placing the pots in a cold frame, or if sown in open beds covering with a mulch, will have the same effect. If seeds are placed in a cooling chamber or refrigerator, they should be packed with some dry and absorbent material such as peat or charcoal, and placed in sealed jars to prevent any change of moisture content of the seeds taking place. The following are particularly helped by the above treatments: Peony, Tulip, Helleborus, Trollius, Mecanopsis, Davidia, Prunus, Cydonia, Magnolia, Juniperus, Quercus, Castanea, Clematis, Fagus, Calycanthus, Rosa, Gentiana, Pentstemon, Mespilus. The seed of the majority of hardy bulbs—Muscari, Erythronium, Crocus, Colchicum, Trillium, also respond to this treatment. Stratification can be carried out with the larger and woody types of seeds which are then sown in the early spring before germination has commenced.

Spring sowing is suitable for the following but autumn sowing will also give good results: Eremurus, Iris, Roses, Hemerocallis, Anemone, Viola, Dodecatheon. Sowing in the autumn should be late enough to prevent immediate germination, otherwise the young seedlings may be harmed during the winter.

By far the largest number of kinds can be sown in the spring, or if carefully handled, and attention given to watering and shading, in the summer. This includes most annuals and hardy perennials. Included are seeds of certain types of bulbs, e.g., Allium, Tigridia, Morea, Gladiolus,

Hyacinthus candicans, Sparaxis, Zephyranthes, Anomatheca, Watsonia, Babiana and Tritonia. Also the following: Rheum, Ranunculus, Abies, Picea, Cedrus, Vitis, Syringa, Polygonum. All species of Lilium benefit by sowing the seed immediately it is ripe, but the following will germinate if sown in the spring: L. regale, longiflorum, Henryi, philippenense and its var. formossanum, Wilmottiae. Liliums are best sown in a frame and allowed to remain there for two seasons before moving.

Sowing Seeds Under Glass:

The use of glass assists in controlling the environment. It is thus possible to reproduce as nearly as possible the natural conditions required for germination. With seeds of hardy plants, the use of a heated glass-house or frame is not recommended, otherwise the growth will be forced, and the resultant seedlings become long and leggy.

The use of specialised composts—such as the John Innes Seed Compost—is recommended, and wherever possible, the soil should be sterilised before sowing. If this is done, the turf and leaf mould must be sterilised separately at a temperature of 180° F. for ten minutes. (See Lawrence & Newell's "Seed and Potting Composts").

Containers should be clean, and free from harmful organisms, both insect and fungal. Pots, seed pans and flats should be scrubbed and allowed to dry before use. Boxes ("flats") should be well scraped, and if necessary, sterilised by steam or chemical means.

Drainage in pots and seed pans should be adequate. It is usually formed by using pieces of pots ("crocks"), and should occupy at least one-quarter of the pot in depth. On top of the crock should be placed some fibrous material such as turf fibre, sphagnum moss, or partially decayed leaves or hops, which prevents the soil from becoming washed down into the drainage. Soil should then be added, and firmed, until the pot is filled up to within one inch of the top. The surface should be levelled and the seed sown. In the case of fine seeds, the top of the soil should be coated with white sand, to allow the seed to be seen. This will allow a more even distribution of the seed to be made over the surface of the soil. Fine sand can also be mixed with such seed to achieve the same result.

The method of filling a tray or flat for seed sowing is identical, except that the drainage usually consists of a layer of fibre, leaf mould or turf in place of crocks. When firming the soil, make sure that the corners are well firmed. Uneven firming will cause subsidence later, and

this may have harmful effects upon the germinating seeds.

After the seed has been sown, a light covering of soil should be given. Watering should be undertaken with a fine rose, or, better still, by immersing pot or flat in water. The level of the water should not reach above the level of the compost, otherwise the seed will float, and uneven distribution of the seed will result. After placing the pot or tray on a flat surface to allow the surplus water to drain away, the pots should be placed in a level position on a greenhouse bench or in a propagating frame.

Covering the boxes, pots or pans when under glass usually gives better germination. This can be done either with glass, paper, or some more opaque material such as asbestos sheeting.

It should be remembered that light is not needed until germination has taken place, and seed pots may be kept in darkness at first, provided air, temperature or moisture are properly controlled.

The glass will need lifting daily, the collected moisture wiped off, and replaced. Following germination, the glass should be gradually lifted to allow light and air to enter. Within a week of germination the glass and shading should be removed entirely to permit maximum entry of light and air.

After the seedlings are large enough to handle, they should be pricked off into flats, at distances suitable for the growth requirements of the particular species. Where the resultant plants are required for outside purposes, they must be gradually hardened off prior to placing in outside frames. Plants for greenhouse displays will require potting on as they grow.

Very Small Seeds, e.g., Begonia, Thyme, Poppy, Petunia.

The seed of these plants should be dusted on the surface of the seed pot or pan. Sphagnum moss dust can be placed on top of the seed compost, and the seeds sown on top of the moss. After watering, either by immersion or by a fine rose, the seed will sink down through the moss. This will assist in keeping the seed moist and promote even germination.

Care must be taken to avoid over-watering, and this can be prevented by surrounding the seed pot with sphagnum moss. This will assist in keeping the soil moist and help to obviate the necessity of frequent watering.

Seeds of Alpines

These should be sown as soon as ripe (autumn). Sown in pots, they should be stood outdoors, but protected from

the rain. Frost and snow both have beneficial effect on these seeds. Watering should be by immersion only, as many seeds are fine and dust-like. If covered with a sheet of opaque material (asbestos), moss and weeds will cause little trouble. As soon as the seedlings are large enough to handle, they should be pricked off into a suitable mixture, and grown on under glass until of reasonable size, when the seedlings should be gradually hardened off and placed in an open frame.

Azalea and Rhododendron Seed

This seed should be sown under glass as soon as it has been collected. If this is done, maximum germination will take place within five weeks, and the germination percentage will be high. Viability is very low after the seed has been stored for periods longer than six months.

Compost for these seeds (and for most ericaceous plants) must be acid, and should be either the John Innes Seed compost, without the addition of the superphosphate and lime, or a mixture of turf, peat or leaf mould and sand, or of just the last two items. These materials should be sieved through a $\frac{1}{4}$-inch sieve.

Seedlings of these plants should be pricked out as soon as possible into flats containing a similar mixture to the seed compost, with the addition of extra turf.

Many kinds of seeds—in addition to **Azalea and Rhododendrons**—prefer acid soil conditions. The following can be sown in acid composts: Gaultheria, Ericas, Vaccinium, Lilium canadense, L. philadelphicum, L. auratum, L. superbum, Hypoxis, Trillium, Lobelia, Cornus, and Yucca.

Seeds of these plants should be sown in soil which must not be allowed to become dry. On the other hand, drainage must be adequate, otherwise sourness of the compost will result. A compost which contains sphagnum will be suitable.

Fern Spores

Spores differ from seeds in many ways, the chief being that they do not contain a young embryo derived from the fertilisation of the male and female gametes.

Spores should be sown on the surface of the compost, and a sheet of glass placed over the top. Watering should be by immersion only. Sowing the spores on a brick, and keeping this continually moist with an atomiser, will also bring about germination. The germinating spore gives rise to a small green body, and it is from this structure the true fern plant grows. Until this stage is reached the container should be kept in a shady and moist atmosphere.

SUGGESTIONS FOR THE CULTIVATION OF NEW ZEALAND PLANTS

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1. Growing From Seed

(a) Sow not later than August, but it is wise to sow as soon as possible after the seed is ripe.

(b) The seed-bed should be in a sheltered place, and semi-shaded for preference. Unless the soil is light, mix in as much leaf mould and sand as possible.

(c) Make a small frame the size of the bed—say 2 feet by 4 feet—and cover with scrim tacked on, or manuka scrub carefully tied on. One made like a tent is more satisfactory than one with a flat top.

(d) Sow in drills 4-6 inches apart and cover with sandy soil rich in leaf mould to prevent caking.

(e) Berries should be well mixed with sand to separate the seeds; the same applies to the sticky fruits of Pittosporums or Matipos. Then sow the sand in the drill. This ensures that the seedlings are not overcrowded.

(f) Kowhai seed should not be shelled from the pods. Pour boiling water on the pods in a basin, leave for 3-4 days, and plant the pods.

(g) Place the frame over the completed seed-bed and water if the soil gets dry. In the spring, gradually harden the young plants by lifting the frame on different sides for a day at a time, removing altogether during rain or on a dull cool day.

(h) If the surface soil of the bush is scraped up and sown in the drills, many seedlings of different kinds will be obtained.

(i) If the seedlings are too thick, they may be pricked off like flower seedlings in another bed. Cover with a frame until established, and harden off as before.

(j) In the following March-April all seedlings in the bed should be wrenched with a sharp spade after rain or after soaking the bed thoroughly.

(k) In mild districts the seedlings may be lined out in May-June, but where winter frosts are severe this is better postponed until late August.

(l) Lined-out seedlings should be wrenched each year and planted out in the native garden when large enough.

2. Growing From Cuttings

The easiest plants are Hebes (Veronicas), Olearias, Senecios, Brooms, and Fuchsia. (See notes in May bulletin.)

3. Collection of Wild Plants (May to August are the best months)

(a) Do not collect from areas where the plants are protected. On no account remove all the seedlings from one area; rather practise a judicious thinning. Collect from the edges of the bush and along side paths where the plants are exposed to a certain amount of wind and sun.

(b) Take first-year seedlings wherever possible, otherwise take small plants in preference to large ones. Dig up carefully to preserve as many roots as possible, and remove most of the soil from the roots.

(c) Keep the roots moist by wrapping in damp moss or dipping into a puddle of soil and water.

(d) Line out the seedlings in the nursery. If the situation is exposed, shelter the seedlings by sticking manuka twigs in the soil between the rows.

(e) Wrench plants the following autumn and again each year until the plants are large enough for their permanent positions.

(f) Plants such as tussocks and other native grasses growing in open exposed situations may usually be transplanted directly to their permanent positions.

4. Preparation of the Ground for a Native Section

Where possible, choose a fairly moist, not wet, and sheltered area. Dig deeply, if possible double dig, but do not bring any sub-soil to the surface. A crop of potatoes or similar inter-cultivated crop is an excellent preparation. For the first planting use mainly hardy plants, such as ribbonwods, Coprosmas, Hebes, Senecios, and Olearias, These are quick-growing, and provide shelter for the less hardy and slower-growing plants. Natives grow best in close association with each other, and may be planted closer than ordinary shrubs or trees. The aim should be to get the ground completely covered so that digging and weeding are not necessary. A top-dressing of leaf mould or well-rotted manure in the early summer helps to keep the soil moist in dry weather. As the shrubs and trees develop, do not hesitate to prune where necessary. Remove the lower branches of the taller plants and keep the shrubs pinched back to make the ball shape.

Do not attempt to complete the native section in one year. It is better to trench a small area each year and extend as plants become available.

ANSWERS TO CORRESPONDENTS

History of the Potato

Sir Walter Raleigh never saw a potato in South America or Virginia, and he did not introduce it into England about 1588. So far as we can ascertain from the published researches of W. E. Safford and R. N. Salaman, the first written account of the potato is to be found in the journal of Cieza de Leon, who found it in cultivation in 1538 around the high altitude villages in the Andes. The Incas used both guano and irrigation in its cultivation, and stored vast quantities as food for the army and as a reserve against famine. For long storage the potatoes were cured by frost and then dried. The Spaniards worked the great Potosi mines with slave labour maintained almost entirely on dried potatoes.

Potatoes were later in regular use by Spanish ships for food on the homeward voyage, and it was probably in this way they were taken to Europe. We know that they were growing in Seville in 1570, in Italy and Belgium in 1585, and in Vienna in 1588. In 1596 the English herbalist, Gerard, mentions the potato in a catalogue of the plants grown in his garden.

" Unfortunately, he let slip the remark, without further explanation, that he had received the roots from Virginia. This is clearly an error, for the potato was at that time unknown in Virginia, and did not reach there until over 100 years later." It is possible that Gerard's tubers were obtained from the stores of one of Drake's ships which picked up Hariot, Sir Walter Raleigh's representative and the leader of the Virginian colony, from Roanoke, and landed them at Plymouth on July 26th, 1586. " Hariot, one of the foremost scientists of his day, brought over a collection of plants from Virginia, and it is possible that tubers collected in South America were mistakenly included by Gerard in the collection from Virginia."

Actually Raleigh was never within 2000 miles of the South American indigenous potato. There is some evidence, however, that he may have grown potatoes on his estate at Youghal, in Ireland, towards the end of the 16th century.

We do know that the potato was grown in Ireland as a field crop before 1663, but it made practically no progress in England and Scotland until nearly a century later. It was from Ireland that it appears to have been taken to America about 1720.

John Evelyn on Tree Planting 250 Years Ago

" For I observe there is no part of husbandry which men more commonly fail in, neglect, and have cause to

repent of, than that they did not begin planting betimes, without which they can expect neither fruit, ornament or delight from their labour. Men seldom plant trees till they begin to be wise, that is, till they grow old and find by experience the prudence and necessity of it. When Ulysses, after a ten years' absence, was returned from Troy, and coming home found his aged father in the field planting of trees, he asked why (being now so advanced in years) he put himself to the fatigue and labour of planting that from which he was never likely to enjoy the fruit. The good old man (taking him for a stranger) gently replied, 'I plant against my son Ulysses comes home.' "—Silva; or, a Discourse of Forest Trees.

SUGGESTIONS FOR A COURSE IN HORTICULTURE

In response to several requests, we set out below a programme of garden operations linked with discussion topics and laboratory work designed to cover the syllabus in Horticulture for the School Certificate examination. The practical work and sowing times are planned to fit in with the school year and for the climatic conditions of Canterbury.

Outdoor Operations.	Observations, Discussions and Laboratory Work.
February Lining out wallflower, sweet william, forget-me-not. Sow Iceland poppies. Layer carnations. Bud roses and fruit trees. Wrench tree seedlings. Staking of late-flowering perennials. Disbudding of chrysanthemums. Plant bulbs and corms. Spray and dust for pests and diseases. Seed saving. Sow lettuce, radish, beetroot, peas, dwarf beans, turnips, parsley, spinach, silver beet. Plant cabbage, e.g., Savoy, Leeks.	Flower structure and functions. Pollination and fertilisation. Life histories of cabbage aphis, diamond-backed moth, white butterfly. Virus diseases of potato and tomato. Observations on height, colour, time of blooming of annuals and biennials.
March Wrenching of wallflowers. Cuttings of violas, pansies, pentstemons, etc., in boxes or under scrim frames. Sowing sweet peas. Seed saving. Planting bulbs. Preparation of soil and the sowing of lawns. Sow onions, lettuce, radish, carrots (early variety), spinach, turnips, parsley, cabbage, e.g., Flower of Spring. Plant cabbage, silver beet, spinach beet.	Composition of air. The relation of oxygen, nitrogen, carbon dioxide to plant growth. Leaf structure. Respiration. Transpiration. Photosynthesis. Cut-worm, Porina and grass grub as garden pests.
April Planting of spring-blooming biennials and perennials from nursery beds. Layer shrubs. Trim hedges. Early cuttings of shrubs, small fruits and hedge plants. Wrenching of shrubs and trees after rain. Making compost. Selection and greening of seed potatoes. Sow broad beans. Plant cabbage.	Modifications of stems and their use in plant propagation. Stem structure to explain callusing of cuttings and healing of wounds. The cause of rusting and the care of garden tools.

May

Planting of wallflower, sweet william, forget-me-not, tulips. Sowing seed of natives and hardwood trees in open ground. Main planting of hardwood cuttings, including herbs such as thyme and sage.

Soil: Formation and types.

June

Planting roses, shrubs and trees. Pruning of deciduous trees, shrubs and fruit trees. Plant shallots, potato onions, tree onions.

Characteristics of sand, clay, silt, organic matter, humus.

July

Planting trees and shrubs. Trenching. Drainage. Pruning. Taking of scions for grafting. Lifting, dividing, and replanting of herbaceous perennials.

Drainage and aeration. Effects of cultivation. Minerals and plant nutrition. Lime and acidity. Farmyard manure and compost.

August

Lining out seedlings and rooted cuttings of trees and shrubs. Planting of early flowering annuals, such as nemesia, clarkia, godetia. Sowing of half-hardy annuals in boxes under glass. Digging in green manure. Divide mint, thyme, sage, savory. Plant cabbage and lettuce. Sow radish, spinach, lettuce.

Sources, properties and uses of common fertilisers. Seed and potting composts. Planning of the vegetable garden. Rotation and succession of crops.

September

Sowing of hardy annuals in the open ground under scrim. Lift and divide dahlias. Grafting of fruit trees. Pricking off annuals into boxes. Sow onions, beetroot, parsley, spinach, turnips, peas, carrots, silver beet. Plant potatoes, artichokes.

Seed structure and germination. Enzymes and their action. Conditions for germination. Soil temperature and the factors affecting it. Damping off and its control.

October

Sowing half-hardy and tender annuals in the open ground under scrim. Pricking off hardy annuals into beds in open ground. Sowing forest trees such as pines and cypresses. Sow radish, lettuce, parsnips, leeks. Plant main crop potatoes.

Soil micro-biology: Bacteria and fungi as friends and foes of the garden. Sterilisation and partial sterilisation of soils.

November

Planting of annuals. Sowing annuals in beds and borders to be thinned and left to bloom. Sowing of biennials and perennials. Plant gladioli. Spray fruit trees. Sow main crop carrots, parsnip, N.Z. spinach, main crop peas, sweet corn.

The improvement of plants by selection and breeding. Life histories of pests such as codlin moth and diseases such as rose mildew.

December

Sow seed of wallflower, sweet william and forget-me-not. Stake and tie perennials. Pinch back annuals to make bushy plants and delay flowering. Spray fruit trees. Sow main crop peas, beetroot, spinach beet, silver beet, swede, dwarf beans, runner beans, sweet corn, cabbage. Plant leeks, celery, cucumber, marrow, pumpkin.

Biological control of pests by predators and parasites. The horticultural geography of New Zealand.

GREAT FARMERS

2

Thomas Coke of Norfolk

In Coke the system of large farms and large capital found their most celebrated champion. In 1778 the refusal of two tenants to renew leases at an increased rental threw a quantity of land back on his hands. He decided to farm it himself. From then until his death in 1842 he was at the head of the new movement. His energy was richly rewarded. The annual rental of Holkham rose from £2200 in 1778 to £20,000 in 1816. The sandy soil produced only a scanty yield of ryecorn and no wheat. No manure was purchased, a few Norfolk sheep with backs like rabbits and a few half-starved cows were the only live stock. Coke determined to grow wheat. He marled and clayed the land, and purchased large amounts of farmyard manure, drilled his wheat and turnips, grew sainfoin and clover, and trebled his live stock. On the light drifty lands grew up the Norfolk proverb "Muck is the mother of money." In the last quarter of the 18th century the value of bones as fertiliser was realised. The discovery was assigned to fox-hunters cleaning out kennels and to farmers near Sheffield, where refuse heaps were formed of bones not used for handles of knives. The bones were ground and applied as manure. Coke used them largely, and also introduced oilcake. Under his example and advice stall feeding was practised. Cattle from all parts of England and Scotland were fattened in Norfolk for the London market. This fattening in stalls gave large amounts of manure, which, applied to the land, enabled wheat to be grown. Thus was the maxim verified, "Never sow a crop unless there is condition to grow it luxuriantly."

After improvement in soil he turned his attention to live stock. He tried many breeds, and then adopted Devon cattle and Southdown sheep.

Up to his time grass lands were wholly unimproved. If meadow or pasture was to be renewed or arable was to be laid down in grass, it was either left to tumble down, or seed was taken from the ricks, usually full of weeds. In 1760 Stillingfleet had distinguished the good and bad herbage plants and had illustrated them, and others helped to try these out. Coke was the first landlord who appreciated the value of distinctions. In May and June, when the grasses were in bloom, he gave simple lessons to the children of his tenants. They scoured the country to procure his stocks of seed.

Experiments with the drill on 3,000 acres convinced him of its economy of time and seed. He saved in seed a

bushel and a half per acre and increased the yield by 12 bushels per acre. He tested every novelty himself and offered to his neighbours only the results of his own successful ex perience. It was thus that the practice of drilling turnips and wheat and the value of sainfoin, swedes, mangels, and potatoes were forced on the notice of the farmers. His farm buildings, houses and cottages were models to other landlords. He offered leases for 21 years and thus guaranteed to improving farmers a return for their energy and outlay.

But farmers were difficult to convince. Wheat instead of rye might be grown with success, turnips if drilled were more easily hoed and yielded a heavier crop than those sown broadcast, marl and clay might help to consolidate drifting soil, but the farmers were suspicious. Politics ran so high that they called Coke's Southdowns "Whiggish Sheep." "It might be good enough for Mr Coke to grow wheat but it is not good enough for me." As to potatoes the best they would say was that "perhaps they would not poison the pigs." Coke calculated that his improvements travelled at the rate of a mile a year.

The Holkham sheep-shearings did much by visual demonstration to break down traditions and prejudices. These meetings originated in 1778, in Coke's own ignorance of farming matters; small parties of farmers were annually invited to discuss agricultural topics at his house and aid him with practical advice. The gatherings rapidly grew larger and Coke soon became a teacher as well as a learner.

—Summarised from "English Farming, Past and Present," by Lord Ernle.

[In 1939 the Editor made a pilgrimage to Holkham, and to the monument erected in the midst of the farm lands on which Coke lavished so much money and care. The memorial consists of a large column with replicas at the base of a muck cart, a plough, an ox, and a group of sheep. The inscription reads: "This column in memory of Thomas William Coke, Earl of Leicester, for more than half a century the faithful representative of this county in the House of Commons, erected by subscriptions originating with the yeomanry and supported by the noblemen and gentlemen of all parties, records a life devoted to the welfare of his friends, neighbours and tenants. Integrity and independence marked his political career; love, honour and regret attend the father, friend and landlord. The arts lament in him a liberal and fostering patron, and AGRICULTURE, to which from early manhood to the close of life he dedicated time, energy, science and wealth, crowning his cenotaph with her emblems, cherishes the precedent and commends the practice of her great promoter and benefactor."]