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No. 1

FRUITGROWING IN NEW ZEALAND.

BY J. A. CAMPBELL, N.D.H. (N.Z.),

Director of the Horticulture Division, Department of Agriculture.

The soil and climate of New Zealand are both highly suitable for the culture of all temperate-climate fruits, while in many parts sub-tropical fruits do extremely well. Fruit can be readily produced on the flats, valleys, and easy slopes, practically throughout both Islands. Notwithstanding this, however, there are certain districts and situations more suitable for fruit-production than others, and this fact requires to be taken into consideration by anyone contemplating taking up commercial fruit-growing as a means of livelihood. The determination of the district in which to establish an orchard depends somewhat upon the class of fruit it is intended to produce.

Stone fruits generally revel in the sunshine, and will flourish in anything up to semi-tropical conditions, provided a requisite amount of moisture is either naturally or artificially provided. Given the sunshine, stone fruits, with the exception of the Cherry, will thrive under a variety of soil conditions; but the Cherry must have a free subsoil. If grown on land having a tenacious subsoil or hard pan, Cherry-trees seldom remain healthy, but are liable to languish or die from gumming and similar causes.

The Apple and Pear will thrive under temperature conditions too low to allow the Peach and Apricot to be raised to perfection, but on the other hand the higher range of temperatures under which the latter fruits can be produced in abundance are not ideally suitable for Apple culture; but even so Apples can be produced under a fairly wide range of temperatures, provided a proper selection of varieties is observed.

Apart from determining the class of fruit to be grown, there are other matters of importance for the prospective orchardist to observe in selecting the orchard site. These include quality of the soil, situation as to sunlight and shelter, drainage, and location in relation to marketing.

SOIL.

Although fruit-trees of one class or another will grow and thrive to some extent on a great variety of soils, to produce a robust tree and a satisfactory annual crop the soil of the orchard must contain the plant foods necessary for the purpose, or they must be provided and maintained by a proper cultural system, including thorough and consistent cultivation, soil aeration, liming, the use of artificial fertilisers, and consistent green-manuring.

To what extent this has to be practised in its entirety depends, of course, on the natural quality of the soil in each case, but a thorough system of cultivation is essential to efficient orchard management. This does not mean an excessive use of the plough; in fact injudicious ploughing is likely to have a detrimental effect on the land; but it does mean thorough ploughing and subsoiling before planting, and one good ploughing each season thereafter. But more important still is the reduction of the soil to a satisfactory state after ploughing, and the frequent disturbance of the surface soil, particularly during the growing-season, when the land is not under a cover-crop.

There is a popular fallacy that poor land is the land for fruit-growing. This contention is justifiable in a comparative sense only; or in other words, a much better showing can be made by fruit-growing on poor land than by any other class of farming; but despite this, a still better showing can be made on good land. In point of fact fruit-growing, being a form of intense culture, is a class of farming in which the original cost of the site is of comparatively little moment, provided the land is of high quality and the other essentials to a sound orcharding proposition are present.

This, of course, does not mean that a good orchard-site should be purchased regardless of price, but rather that it is by no means necessarily wise on the part of a prospective orchardist to reject good land well situated in favour of poor land inconveniently situated, even though the latter can be purchased at £50, £75, or even more per acre cheaper.

Let us consider the position for a moment, apart altogether from the permanent advantages or disadvantages a good or bad location lends to an orcharding proposition. Take Apple-growing on good land at a cost of £75 per acre more than poor land on which the same industry is being conducted. On the basis of ten per cent. interest and sinking fund, the one will be required to return £7/10/0 per acre per annum more than the other. The number of Apple-trees planted to the acre varies from 100 to 150. Let us consider this matter further from the point of view of the lesser number. On the basis of 100 per acre the trees on the dearer land would each be required to produce one and ninepence worth of fruit each season—approximately half a case—more than those on the cheaper land. This quantity can be relied upon to be well exceeded, for a well-conducted orchard of mature trees on good land will produce 600 cases and more of good marketable fruit per acre, while on poor land it will do well to produce half that quantity, and then only after much time

and labour have been spent in improving the condition of the soil. Further, the orchardist who has established on good land can derive a certain revenue for a few years that will assist him in tiding over the period of waiting for his orchard to come into bearing, by raising certain garden crops between his trees, a matter not practicable on poor land.

SITUATION.

In selecting an orchard site every consideration should be given to shelter and sunlight. High winds are detrimental to the well-being of the tree, while sunlight is essential to it. Generally speaking, our worst winds are from the north, west, and to some extent the south. Consequently the land should in preference fall slightly toward the north-east. If natural shelter exists so much the better; if not, artificial shelter should be provided. While theoretically land falling to the north-east is ideal, land so lying is not always obtainable, and in consequence many orchards—and very satisfactory ones too—exist in New Zealand which vary materially from this position; but all the same it must be remembered that the more the land falls toward the windy quarter the more difficult the shelter problem becomes. Southern aspects should be avoided, if at all possible.

One of the most useful and popular orchard shelter plants, and one that does generally well throughout the country, excepting in very wet and very dry situations, is the Lombardy Poplar. Several of the coniferous trees make valuable orchard shelters, but the most outstanding for this purpose is *Lawsoniana*. Several of the Acacias are also useful, the most popular being *A. decurrens*. *Pinus insignis* makes a very fine dense wind-break when planted three or more deep, and is particularly useful where height is required.

DRAINAGE.

Adequate drainage is essential to the fertility of any soil and to the health of plants growing therein, particularly such plants as fruit-trees, which have a comparatively deep and spreading root-system. Some subsoils are open and porous, and are charged with sand or gravel; such cause little trouble from a drainage point of view. The other extreme is a close-grained tenacious soil from the surface downward. Soils of this kind are extremely difficult, if not impossible, to drain satisfactorily, and therefore should be avoided as far as possible for orcharding purposes; but, where they have to be contended with, a thorough system of field-pipe and brush drains should be laid down, and a continuous attempt made, by means of liming, green manuring, and cultivation, to improve the texture of the soil and to make it more amenable to drainage.

Soils of all types between the two extremes referred to are to be met with; and each should be dealt with on its merits, not from a casual survey of the situation, but from an actual study of their drainage requirements, always remembering that bad drainage can be one of the worst foes to the orchard, and more than any other factor

is responsible for unhealthy and stunted trees, poor crops, and the major portion of the physiological troubles that arise from time to time to worry the grower.

LOCATION.

This is an all-important matter to the success of any commercial-orcharding venture. The production and sale of fruit is a competitive business. Fruit-growers do not look upon each other as rivals, but rather as brothers in an industry; but, although more subdued than is the case in the ordinary business world, the competitive factors exist. While the demand for fruit is in excess of the supply, the orchardists' position is quite a happy one, but as soon as the supply exceeds the demand—a position which may arise sooner or later with respect to any country that has a growing fruit-industry and ample room to expand—the subdued rivalry between growers becomes increasingly acute.

Unfortunately there are no reasonable means of avoiding such a position arising. It is not competent for anyone to prohibit the further planting of fruit-trees, consequently orchard planting when once popularised is likely to go on until the market actually collapses through over-production, at which time there may be thousands of acres of planted trees still to come into bearing.

In these circumstances the industry would be in for a period of bad times, for although orchard-planting might immediately cease, the fruit crop already in excess of requirements would be annually increased as the more recently planted areas came into bearing. The position would resolve itself into one of the survival of the fittest, with the result that, unless some very needed relief were forthcoming, many of the weakest must eventually go to the wall. Weakness, of course, manifests itself in many ways, but the most potent source is low acreage-production, particularly when combined with faulty location. An orchardist in these circumstances whose acreage-yield is low, owing to the nature of the land on which his orchard is established, and who has inconvenient or costly transportation charges to meet, is likely to be among the first to go out. On the other hand, one who has an efficiently-managed orchard established on good land close by a large town or city, or otherwise has at his command cheap and efficient means of placing his produce on the market, is more likely to be able to carry on while others fail.

Fortunately when a position such as that outlined threatened the fruit industry of New Zealand a few years ago, relief did come in the form of an oversea-export trade, consequently the survival of the fittest issue was not fought to a finish. Had it been, the economic factors in orcharding would without doubt have clearly demonstrated themselves. As it was, the acute position was sufficiently sustained to bring disaster to quite a few engaged in the industry.

As far as practicable an orchard should be established on good land in the vicinity, or within easy and economic reach, of a large town or city, with a railway and port close by to assist in wider distribution of the product within the country or overseas.

A case of fruit is a heavy and cumbersome package from a transportation point of view in comparison with its value, consequently unnecessary transportation must be avoided. Pence per case saved are an important factor in the fruit industry at all times, but in seasons of stress pence saved as against pence expended are likely to mark the difference between success and failure.

(*To be continued.*)

TREE PLANTING—WILL IT PAY?

BY JAMES YOUNG, F.R.H.S., N.D.H. (N.Z.),
Curator, Christchurch Botanic Gardens.

A few practical directions may, it is hoped, be acceptable for the guidance of those of limited experience who may be entrusted with the work of planting trees on a large or small scale, either on public or private property.

The ground to be planted should be properly fenced to safeguard against sheep, cattle, and horses, and against hares, rabbits, and any animals that might in any way injure the trees at any stage of growth.

The surface should be made thoroughly dry by means of open drains.

Herbage of whatever kind should be kept down, so that it does not at any time over-top and choke the plants. To guard against this, ploughing is the best and cheapest method where practicable.

The plants should always be of a size properly suited to the soil, herbage, and situation. Generally speaking, pine and fir plants, two years old—seedlings, or what are *termed* seedlings one year old (one year bedded and one year planted in nursery lines)—are preferable.

Planting is generally done in Britain at 4 feet apart, or say 3,000 plants to the imperial acre.

Great care should be taken that the plants are not put into the ground deeper than they stood in the nursery.

The planting should be of one species and not mixed, and, if the soil varies in quality, as it commonly does, the planting should be done on the grouping system. For instance: the Norway Spruce, by itself, on soft, damp, boggy land; Scots Fir, on gravelly and sandy places, or on any soil with a mixture of sand or small dent in it; Larch, on all suitable dry soils and warm elevated situations, but *not* on frosty, damp places, or areas completely exposed to the sea or to high prevailing winds.

In thinning, take out every alternate plant, or, in other words, reduce the crop to about 800 trees to the acre to begin with; that is, when the trees are about the height of a man. After this first thin-

ning, care should be taken to remove all branches which overlap in such a way as to cause injury to the young trees. A safe and simple rule for subsequent thinning is to retain those trees that measure in girth, a little above the swell of the roots, as many inches as their height in feet. Continue this as long as thinning is required, and cease thinning altogether after the crop is reduced to about 400 trees to the acre, or say about 10 feet apart on the average.

After the lower branches are dead up to about six feet from the ground, cattle and sheep may be allowed to graze in the plantation, and the letting value of such will increase periodically.

The state of maturing of the plantation must at all times be duly observed, so that it might be cut down at a proper age, and when at its highest attainable value. Larch plantations are generally at their highest value at 70 years, Scots Fir at 100 years, and Norway Spruce at 60 years or thereby. In each case, however, much depends upon the soil and situation.

The disposal of the crop should usually be effected by private tender. When for sale, the trees should be numbered, or at least marked, and valued by the forester, and if the offer is not satisfactory the trees can remain till a suitable offer is received.

The following varieties are suitable for forest plantations:—

Thuja gigantea.—North-west America, known as the Yellow Cypress of the colonials, also known as Oregon Red or White Cedar—a straight tree, in some instances known to have attained a height of 325 feet, with a stem 22 feet in diameter. It furnishes a valuable building timber of a pale or light yellow colour, susceptible of high polish, and remarkably fragrant. It is light, soft, smooth, and durable, and makes the finest of sashes, doors, and mouldings. Shingles of the best quality are made from this tree, and the species has just lately been chosen for the Prussian forests and is to be planted on a large scale.

The Western Yellow Pine, *Pinus ponderosus*.—This is often called the Bull Pine, a name that is often applied to other members of this family. This tree is never found in dense forests, like the Douglas Fir and other conifers. Commercially the wood is of no great value, as it is lacking in strength, and therefore unfit for heavy work. When exposed to the weather it decays very quickly.

Abies Douglasii.—The Oregon Pine or Fir, or, as it is sometimes called, the Yellow Pine of Pugay, named after the district which yields this tree as the principal timber for export. It is of great commercial value in the timber trade. A densely-wooded forest will contain about 36 fully-grown trees to the acre. The timber is fine grained, heavy, strong, and soft, and hence is easily worked. Yet it is firm and solid. It is splendid for masts and spars, ships' planks, and piles, and is also valuable for flooring, being for that purpose regarded as the best timber in California. It will bear a tension of 3 to 1 as compared with the Sequoia. It is the strongest wood among conifers on the North Pacific Coast in resisting both horizontal strain and perpendicular pressure.

Salix alba—the Silky or Huntingdon Willow of Europe.—It resists the frosts of Norway, and it is positively known that the Silky Willow will live to an age of 150 years and probably much longer. It is suitable for wet places not otherwise in cultivation. Its height reaches to 80 feet; circumference of stem, sometimes to 20 feet. The wood is smooth, soft, and tough, bearing pounding and knocking better than any other British tree. It is highly suitable where lightness, pliancy, and elasticity are required. Also worked up for cricket bats and for boxes and many utensils, as well as for matches.

Sealing estimates the value of an acre of Willow timber to be about £300.

The Golden Osier, *Salix vitellina*, is a variety. This is the best for cricket bats, of which articles about 100,000 are annually required for Australia alone. This Willow is also valuable for paper-material.

Cupressus macrocarpa of California, from Monterey to Noya, grows in the granite as well as the sandstone formations, and sometimes in Sphagnum moors. This beautiful and shady tree attains a height of 150 feet, with a stem of 9 feet in circumference. It is one of the quickest growing of conifers, even in poor dry soil. It is also one of the best shelter trees on sand dunes—naturally following the coast line and never extending many miles from the shore—and in localities where the temperature does not rise above 80 degrees. It even proves to be hardy in Oslo. The wood is remarkably scented, and is richer in its yield of tar than that of the Scotch Fir.

Pinus laricio or Corsican Pine of South Europe.—This tree attains a height of 150 feet. It is a splendid shelter tree, particularly for the coldest regions. It is also cultivated at Oslo. It will succeed in stiff clay as well as in sandy soils, and even on sand dunes. The wood is pale, and towards the centre dark, very resinous, coarse-grained, elastic, and durable, and much valued for building, especially for water-works; valuable also for its permanency underground. There are three main varieties of this pine: The Austrian variety is better adapted than the typical *Pinus laricio* for planting on rolling sands in very exposed places.

Pinus insignis was most extensively distributed through the Colony of Victoria and other parts of Australia by the late Baron von Mueller in 1859, not so much as a timber tree, but to afford early shelter.

Pinus radiata, Don.—Some writers confound this species with *Pinus insignis*, to which in many ways it has a strong resemblance. The general appearance of both trees is similar, but the leaves are more slender and much shorter, and the cones are three times longer in *Pinus radiata* than in the other. *Pinus radiata* is an excellent tree for planting on the sea coast, even within the influence of salt water. An excellent timber which is used for boat-building in California.

The Establishing of Forest Nurseries.—The general and most practical system is to establish the nursery in an exposed position and in poor, light land.

Some Advantages Resulting from Judicious Planting.—Judicious planting and skilful culture of plantations combine natural and private interests in an eminent degree, for, besides the real or intrinsic value of the timber with other produce of woods available for arts and comforts of life, judicious forest-tree planting improves the general climate of the neighbourhood, and the staple of the soil as regards the gradual accumulation of vegetable matter; affords shelter for live stock; promotes the growth of pastures and of corn and other crops; beautifies the landscape, and thus greatly and permanently increases the value of the estate and adjoining lands. If, on the other hand, we turn to those soils emphatically termed wastes—exposed, elevated lands, bogs, and sterile sands—soils which we know bulk so largely in Canterbury, we find them clothed with the lowest and least valuable products of the Vegetable Kingdom.

ERICA (Heaths).

BY T. E. WEST, Dumgree, Marlborough.

In the Heath section of flowering plants, we have a very large collection comprising about five hundred varieties. Of these, about three-quarters are natives of South Africa, the rest being divided between Britain, Ireland, Germany, and Portugal.

Although there are five hundred varieties, I do not think more than one-third are in cultivation. They are propagated by cutting firm side-growth about one inch to one and a-half inches long. These are taken off with a heel; this being trimmed and the leaves removed for half an inch from the bottom, they are ready for insertion in the cutting-pots which have been previously prepared. The composition used is peat and silver sand. The pots are half filled with crocks, largest on the bottom and fine on top, then a layer of rough siftings from peat. This is followed by prepared soil of varying degrees of fineness, to within an inch of top. Cover with half an inch of silver sand, water thoroughly, and compress firmly. After the cuttings have been dibbled in, cover with bell-glasses and stand on a bench in the propagating house or in a well-shaded glass-house. When rooted they are potted-off into two-inch pots, and from these into four-inch, and when well established they are ready for planting in the open ground or potting as specimens for glass-house or conservatory. They can also be propagated from the young green points. The same method is used as in the harder growth, with the exception that a joint is used instead of a heel and they are given bottom heat. They are very hardy and easy to grow. They enjoy a sandy peat, but this is not essential, and they will thrive well in good maiden soil or fibrous loam. They do not like old garden soil that has been manured with either stable or artificial manures; to be successful with them avoid manur-

ing, water in hot dry weather, and top-dress occasionally with an inch or two of fresh soil.

When specimens of Heath are being planted in an old-established border you should remove the soil eighteen inches deep and two feet wide and fill with fresh loamy soil; tread in firmly after planting, but leave the surface loose to prevent soil-cracking and so evaporation of moisture.

To my mind no flowering plant gives more satisfaction than the Heath. With colours varying from pure white to scarlet, and having such a long period of bloom, they are worthy of a prominent position in both our public and private gardens, especially as varieties varying in height from one foot to ten feet can be procured. They adapt themselves to any position from the shrubbery to the rockery, and nothing makes a more beautiful display than a massed bed of the dwarf *Ventricosas*, which bloom in the spring and last in flower for two months or more.

Selected varieties such as *Cavendishiana* (yellow), *Cerinthoides coronata* (scarlet), *Grandinosa* (white), *Hybrida* (red), *Hyemalis* (pink and white), and *Melanthera* (lilac) make perfect specimens for glass-house or conservatory.

From any of our up-to-date nurseries a selection can be supplied for any purpose or position in open ground, and with varieties that will give one a Heath bloom practically all the year round.

SOME ASPECTS OF HORTICULTURE IN ENGLAND.

BY MISS O. G. MURGATROYD, N.D.H. (N.Z.),
Balmoral, N. Canterbury.

Kipling figuratively called England a garden, and a New Zealander's first impression is that it is literally all garden; even the uncultivated parts are only wild gardens. After Canterbury's tussock-clad hills and brown paddocks one is duly impressed by the greenness of England, especially of the southern counties, even at the end of winter. This leads one to suspect that an average English winter is not as severe as most New Zealanders imagine. But though temperatures may not fall much below freezing-point for long, the damp atmosphere and lack of sunshine have the same effect on plant life as Canterbury's frosts. In Kent Geraniums (*Zonal Pelargoniums*) seldom survive the winter in an unheated greenhouse; they "damp off" so easily.

Occasionally there are terrible winters, as two recent ones have been, and they tested the hardiness of numbers of new plants which have been introduced, especially from China and Tibet, during the

last thirty or forty years. Many gardeners were waiting for such a periodical visitation to weed out the less hardy importations. Trees and shrubs grow so slowly in England, that their owners object strongly to cutting them out when well-grown. A friend grew a Blue Gum (*Eucalyptus globulus*) to a height of thirty feet and was very proud of it, then to his great disappointment a hard frost killed it. Some plants are so attractive that they are worth planting in spite of the risk of early death, but many English people like to choose hardy ones.

Often spring in England is long in coming, but when it does come, it is wonderfully swift. The south-west wind is gentle, warm, and damp, and the rain with it is warm too, and interspersed with plenty of sunshine. So the soil is nicely heated, growth is quick, yet sturdy, and soon "April showers bring May flowers."

Most garden-work is very much the same here and there. Even staking of large herbaceous plants has to be done in both places, as, though on the whole there is much less wind in England, gales do sweep across the country occasionally, and, unless they are carefully tied up, severe thunderstorms with heavy rain batter one's most precious specimens.

The love of gardening permeates the whole of English society and expresses itself in the gay window-boxes and allotment-gardens of crowded cities, as well as in the beautifully planned and carefully tended acres of flowers, lawn, trees, and shrubs surrounding great mansions. Of course there are neglected gardens, rather sad, deserted places belonging to empty houses, but the grass on the lawns is only a few inches longer than if it were regularly mown. Growth is not usually so rank as it is here, but probably neglected gardens recover quicker in the Dominion.

The gardens of England are so varied in size and style that it is impossible to generalise or to attempt to describe many. In suburban and what are called residential areas people take a great pride in having neat lawns and bright flower effects, even if they do not care to work for these results themselves. Such people are a boon to small nurserymen, who employ a number of jobbing gardeners and take charge of as many gardens as they can, supplying seedlings and bedding plants from the nursery as required. This method works satisfactorily; though gardens rather lack individuality as far as the plants are concerned, for, from the nurserymen's point of view, it is easier to grow large batches of popular bedding-plants than numerous small quantities of rare ones, which are probably difficult to rear.

Bedding-out half-hardy plants is still greatly used in spite of many writers in horticultural books and papers. They decry this wasteful method of furnishing a garden, but for formal beds and borders it is useful. The old fashion of mixing red Geraniums, white Marguerites, blue Lobelia, and yellow Calceolaria is seldom seen. In ten years I saw it once—a long border against an ivy-grown cottage near evergreen shrubs, in a Yorkshire public park, where, I admit, it looked remarkably effective. Many people dislike all these flowers, when it is only the old crude association which offends. In planning

some flower-beds once, we had to use Lobelia, and eventually put it all into one long oval bed, well-raised above grass, and gave it a backbone of grey-leaved *Centaurea candidissima*. The result was a joy for many months.

Some simple bedding-schemes have been popular at Home for a long time, and never fail to please. Scarlet Tulips with double white Arabis are effective early in spring; or the May-flowering Tulip, Clara Butt, with a carpet of Forget-me-not is an attractive mixture of pink and blue; while Wallflowers usually find a prominent position. Sometimes tuberous Begonias follow, and give a blaze of colour. These are started in heat by a nurseryman or in the green-house belonging to most "desirable residences," as house agents advertise. Perhaps the summer scheme is of *Antirrhinums* in some distinct colours; or grey leaves with pink Ivy-leaf Geraniums; or more elaborate still, standard Fuchsia or Heliotrope plants carpeted with Begonia, Gloire de Lorraine, and intermediate dot-plants of pure white Geranium. As these plants are nearly full-grown and flowering when put out, they are effective over a very long season, but the system of bedding-out does mean much work. Often the formal part of a garden is on the street-side of the house. It is sometimes tiny, and is seldom large; that is, on the outskirts of the great cities. On the opposite side of the house is the main portion of the plot; and this is as private as possible, sheltered by substantial walls from possibly curious eyes of neighbours, who may have the right to cut one's trees if branches obstruct their sunlight. This part of the garden usually shows more individuality than the formal front, and reflects the taste of its owner. It may be all tennis-lawn with narrow flower borders along the walls, but more often a plot about the size of a tennis-lawn is made into a flower and vegetable garden, with two or three fruit-trees, every bit of it interesting and often containing beautiful little pictures.

Many larger gardens are like Topsy, they have just "growed." A bit has been added here and surrounded by a wall, then years later another small patch has been acquired; and so here one finds a small sunk garden with a lily pond; there, through a gap in a hedge is an herbaceous plot; another gap leads to a delightful mixture of fruit, flowers for cutting, and vegetables; a twist in the path, and one is admiring a gem of rock-garden. On the other hand, one sometimes sees a great house surrounded by spacious lawns with specimen trees banking up to thick woods, the rose garden providing the only flowers within sight of it; but half a mile away there are flowers, fruit, and vegetables, with glass-houses where wonderful plants grow.

A feature of the outskirts of large towns and even of villages is the allotment-garden. A field, or waste land between different railway lines, is divided into small sections—an eighth of an acre at most—and for a very small, often nominal rent, the man working long hours in factory or shop, spends summer evenings among his own plants in his allotment, separated by narrow paths from his neighbours. The first allotment-garden was opened by Disraeli at Bingley in Yorkshire; fruit-trees there are full-grown now, so the idea is not a new one. The War gave it a great stimulus, especially to vegetable-growing, and men

doing piece-work in the mills could spend two or three long evenings a week at this recreation, and they produced some splendid crops. City and urban district councils encourage practical lectures to the allotment-holders; periodical shows are held, giving healthy competition; and so the work goes on.

Much of the hand-weeding and thinning of field-crops such as Carrots and Onions, as well as the picking of small fruit, is done by poor women who work early and late. It is not of them that I write now, but of the well educated women who are taking up horticulture with more or less success. On leaving secondary schools, girls go on to a gardening college, where, with a sprinkling of older women, the majority of them really do learn the rudiments of some of the branches of their subject, studying flower, vegetable, and fruit growing, market-gardening, and the various types of green-house work, both for private and commercial purposes. Some take the scientific side chiefly, aiming at the new degree, Bachelor of Science in Horticulture, with the idea of teaching in schools and colleges, or lecturing to adults for some County Education Committee. Another line which is being touched tentatively is landscape-gardening. This holds alluring prospects for women with some artistic ability, and seems a wise course to follow, as it does not entail so much heavy work as practical gardening, and well-educated women are not competing with men of less education and a lower standard of living. A few are doing landscape-work and have as much to do as they wish.

Two lady-gardeners worked up an interesting jobbing connection in London. They always arranged that they should be allowed a free hand in their gardens—a plan which suits many owners very well, as I explained above. So, from very ordinary plots, they evolved a number of charming little gardens, different from each other and from those of other people.

Many New Zealand growers know and use the latest English and American scientific methods of dealing with plants, but a short description of some of the work at one of the English experimental fruit-stations may have some interest.

The station at East Malling in Kent was started just before the War, but very little beyond the collection of root-stocks was done until afterwards. Its main object was the study of apple-stocks produced vegetatively—usually called Paradise—which were supposed to be suitable for dwarf trees of all descriptions. Another station, Long Ashton, was to work on similar lines with Free or Crab stocks produced from seed and always thought to give suitable roots for standard trees.

East Malling collected Paradise stocks from all over Europe, and sorted them into seventeen distinct types, some healthy, some liable to all apple diseases. They were all studied, until now the Directors are in a position to recommend one type for half-standards, another for cordons, a third for fillers, and so on; while tests of the behaviour of the chief commercial varieties of apples on these stocks on different soils have been going on for about ten years. Probably valuable results are already available.

The two stations came to one interesting conclusion. It had been thought that Paradise was always a dwarfing stock and Crab always produced a large tree. This has been proved incorrect, as it is possible to have the whole range from very dwarf to very large, from vegetative stocks and from seed. It is still questionable if a tree on a vegetative stock lives quite as long as one on a seedling, but as it applies specially to standards, the grandsons of present planters can be left to prove it.

Owing to the shortage of labour and consequent neglect during the War, nurserymen all over England and the Continent found their stocks in a bad state, and the supply was much below the demand. The possibility of procuring new ones, healthy and true to type, was eagerly sought, and the two stations were soon able to do good work in this way.

But apple-stocks do not constitute the whole work of the station, though roots for different fruit-trees take a large proportion of it. Silver Blight, particularly in the very popular Victoria plum, has been receiving attention, and on this subject members of the staff picked up clues all over the plum-growing districts. In different parts, old growers told that Victoria trees of several generations ago did not suffer from the blight. Questions and answers followed about the stocks used for budding and grafting these old trees, and eventually bits of them came to East Malling from far distant parts and with very different names. Then it was discovered that they were all alike. Is Silver Blight circumvented?

Black Currants are a source of profit to growers in the Home Counties, and higher prices are received for them than for other small fruit. But the Black Currant bush is sorely afflicted. "Run-off," in which the lower flowers of a strig do not set fruit, is attributed to dryness at pollination-time. More serious troubles are Reversion and Big Bud, the latter caused by a mite living in the bud during winter, when it swells unduly and does not develop in spring. In bad cases almost every bud is affected. Reversion is a mysterious disease which alters the shape of leaves and the character of the fruit of a bush, so that it becomes worthless. These matters are receiving attention at East Malling, but the first dealings with this fruit were a series of manuring experiments, which proved conclusively that the application of 18 tons per acre of farmyard manure was the most profitable quantity, and that artificial fertilizers made no difference, so need not be applied.

Does it pay to grow flowers or fruit or vegetables in England? It seems as if it should, even if rates and taxes are high. Labour is not so dear as it is here, and there is a market for most things. Turnip-tops and cabbage-greens sell well when other green vegetables are a little scarce, so that from one planting of cabbages there may be the first cutting of the hearts, and two or even three cuttings of greens. But as in all horticultural pursuits, the weather is an important factor, and an early spring may make the crop worthless by bringing on more desirable vegetables.

The middleman is blamed for the high prices which the consumer often pays; the grower claims that his share is small. A notorious case was that of a Lincolnshireman who sent several trucks of vegetables to London and received a good price, but carriage, salesman's commission, and market charges absorbed all the money, the farmer's work, rental, etc. being a loss.

In another case a combined fruit-farm and mixed nursery did not pay. Perfect fruit was grown there, some 20 miles from London; the Apples, Cox's Orange Pippin and Bramley's Seedling (some went 40 to the bushel), could not have been better. And yet young plantations of these splendid varieties were pulled out, and the land sold for ordinary farming.

Down in Kent, on a mixed farm, there were 35 acres of grassed orchard with full-bearing standard Apple-trees. The owner ran sheep under them, and probably kept down codlin moth quite well by doing so. The fruit was sold to a buyer who undertook to send pickers and packers and paid between £700 and £800 every year. I imagine the farmer did very little in the way of pruning, spraying, or even grease-banding. It sounds as though fruit-growing pays sometimes.

One of many customs connected with fruit-growing is the way of selling by auction long before the fruit is ready. Buyers take the risk for the next few months, and provide the labour necessary for picking, packing, and disposing of the crop. Of course the trees get broken, perhaps rather badly, but they always do with casual pickers, most of whom are East Londoners, who go into the country in great numbers for the fruit- and hop-picking.

The markets of the great cities have many vagaries. Some varieties of fruit are popular in one city and not in another. Cobnuts are best sent to Cardiff or Hull, while the North of England loves green Apples for cooking. Cabbage-lettuces are seldom wanted when Cos varieties come in, and Arum lilies might just as well be turned out after Easter, even if they have not flowered. These apply in most years, but as a rule the methods and customs vary from one district to another.

Flowers, fruit, and vegetables are grown, and grown well, under all sorts of different systems, and one comes to the conclusion that plants are very long-suffering or that many methods are right.

Combined New Zealand Horticultural Conference.—It has now been definitely decided to hold this in Wellington in January, 1931, and a committee representing the interests concerned (New Zealand Horticultural Trades' Association, New Zealand Park Superintendents' Association, and the Institute) is arranging the details. Particulars will be published when finalized.

NEW ZEALAND PLANTS AND THEIR DIFFICULTIES*.

BY DR. A. H. WILLIAMS.

I feel that I am somewhat presumptuous in daring to deal with such a subject as this, when we number among the members of our Society men like Major Dorrien-Smith, the Rev. A. Boscawen, and our President, who have had far greater experience than I in growing New Zealand plants. But having spent nearly twenty years in New Zealand, and a good deal of that in the company of my late father, Bishop W. L. Williams, who was an accurate observer of the plants of our native land, I have always been modestly enthusiastic about their culture here; though, till recently, I had but small opportunity of actively carrying this out.

In order to account for the admitted difficulty in growing many of the New Zealand plants in this country, I propose first to touch on the remote history of those islands; for it is strange and truly unique. Then I will give some account of the meteorological and physical conditions there as compared with those of Britain.

REMOTE HISTORY OF NEW ZEALAND.

It is now conceded that, in a dim, distant geological era, the land that we now know as New Zealand formed part of a vast continent. This extended far to northern and north-western tropical regions, including New Guinea and the eastern half of Australia. At that time the western part of Australia was separated from the eastern portion by a wide arm of the sea. Southwards this continent extended down to the Antarctic region and was probably in this way connected with the southern part of South America.

In the Eocene Age a crumpling of the earth's surface resulted in the greater part of this continent becoming submerged. Eastern and Western Australia became united. And New Zealand was left in a state of splendid isolation, which it was to maintain, through many thousands of years, till comparatively recent times.

At the time of this isolation the development of the fauna of the world had not passed beyond the stage of reptiles and birds. New Zealand was therefore left with a fairly extensive flora, but a very, very restricted fauna. There were insects of many kinds; birds of many kinds; fish and crustaceans in the waters; a few varieties of lizard; one species of frog; and one species of a lizard-like creature called the Tuatara, which is supposed to be the sole surviving representative of prehistoric reptilian monsters. Of snakes there were

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fortunately none; and of mammals also there were none. It is difficult to picture the conditions of a very fertile land, with a most genial climate, existing for many thousands of years without the presence of man or any other mammal.

Not until somewhere about the twelfth century A.D. did man make his first appearance in New Zealand. For at a time considerably later than the filibustering expedition of William of Normandy to England, an intrepid Maori mariner set out on a voyage of discovery. Some thousands of miles to the south of his home in Hawaiki he found this pleasant and fertile land, teeming with bird life and with shoals of fish in its waters; but with no human beings to make use of this profusion.

He succeeded in returning to his native land with the report of his discoveries. A generation or two later it was decided to make an expedition in force, with the object of peopling this uninhabited southern Utopia. A large party of Maoris, therefore, set out with their wives and families and what stores they could carry, in a fleet of twelve ships. These ships consisted of nothing more elaborate than twin canoes—each canoe being hacked out of a single tree trunk. Each pair of canoes would be connected by a rough deck, on which the only shelter would be small deck-houses thatched with rushes. When one thinks of these brown uncivilized mariners deliberately setting out on a voyage of thousands of miles, over a turbulent ocean, in such primitive vessels as these, the exploits of Christopher Columbus and of our own early explorers seem puny performances by comparison.

With these early voyagers came a species of black rat and a small bat, to be the first wild mammals to inhabit these islands. They possibly came as stowaways hidden in the thatch of the deck-houses. This rat was a mild-mannered gentleman compared with our own brown Norway friend. The latter, since his introduction to New Zealand, has almost, if not quite, exterminated his black predecessor.

From the time of this colonization by the Maoris up to the visit of Captain Cook, about 150 years ago, there would be little change in the fauna and flora of New Zealand, except for the extermination by the Maoris of some of the strange flightless birds, like the giant Moa.

THE FLORA OF NEW ZEALAND.

From this brief outline of what had been going on in this part of the world in prehistoric times, it is natural to expect that the flora of New Zealand would be very dissimilar to that of any other country. For here is a land which originally collected its vegetation from a large continent extending from the tropics to the Antarctic. For many ages it had been cut off from any communication with other parts of the terrestrial globe. Through these countless centuries the plants growing there, whether of tropical or of temperate origin, have been allowed to work out their own development as best to suit the conditions in which they found themselves. During this long period their characters would not be varied by the introduction of fresh species

from other parts. They had not to contend with gross destruction that might have been caused by human agency or by herbivorous mammals. In their struggle for life they would only have to contend with the interference of birds and insects; with overcrowding from their companion species; and with the vagaries of a climate admittedly genial.

One can well imagine the ecstasy of the erudite botanists who accompanied Captain Cook, and of their earlier followers, in being able, for the first time since botany had become a science, to work out and classify a truly virgin flora in a new and isolated country. The few plants that had been introduced by the Maoris, for purposes of food, were easily recognized and did not confuse the issue.

How unique is this flora, may be gathered from the fact that of the 1,700 to 1,800 species indigenous to New Zealand no fewer than 75.4 per cent. are found in New Zealand alone.

Of the comparatively small remainder that are not confined to New Zealand alone, 339 species are also found in Australia only; 82 species are also found in South America only; and 30 species are found in New Zealand, Australia and South America, but nowhere else.

The relationship between the flora of New Zealand and that of Australia is easy to understand; for Australia, though distant 1,000 miles, is, with the exception of small islands, New Zealand's nearest neighbour. But the curious point about this connection is that the plants which are common to these two countries do not include any of those species which are usually considered to be characteristically Australian, such as *Eucalyptus*, *Mimosa*, etc. It is not that New Zealand does not suit them; for, since they have been introduced there, they are apt to increase so rapidly as to become a nuisance. The theory put forward to explain this paradox is that, at the time, in dim, distant ages past, when there was land connection between Eastern Australia and what is now New Zealand, these characteristically Australian plants were confined to Western Australia, then separated by sea from Eastern Australia; and that these plants did not spread to Eastern Australia till after the Eocene upheaval which united the two parts of that continent, but which at the same time cut off New Zealand by many miles of ocean.

For the explanation of the remarkable relationship between the floras of New Zealand and South America we must again have recourse to the theory of the pre-Eocene continent which gave a land connection between these two countries. For it is impossible to believe that germinable seeds could have been carried across the many thousands of miles now intervening.

Among the peculiarities of the New Zealand flora I would mention the following:

The tropical appearance of the forests in a temperate region; the rarity of deciduous trees; trees of very slow growth; trees with dull and unobtrusive flowers; trees and shrubs very commonly dioecious; trees with long-persisting juvenile forms; tangled undergrowth with lianes of many species; the prevalence of epiphytes and filmy ferns.

Then outside the forests we have such things as tree-like speedwells; speedwells closely resembling cyprus; the lily liane (*Rhipogonum scandens*) or supple-jack; the palm lily (*Cordyline*); the giant buttercups (*R. Lyallii* and *R. insignis*); the shrubby daisies (*Olearia*); the woolly-leaved daisy (*Pachystegia insignis*); the shrubby groundsels (*Senecio*); the giant forget-me-not (*Myosotidium hortense*); forget-me-nots that are seldom blue; gentians that are never blue; calceolarias that are white; curious cushion plants (vegetable sheep, *Raoulia* and *Haastia*); palm-like tree ferns; ferns that climb; plants of many kinds with curiously thick and heavily tomentosed leaves; and so on. How one would revel in growing many of these curious or beautiful plants, so different from our old garden favourites, if only they would take a little more kindly to our British climate!

At Tresco, in the Isles of Scilly, Major Dorrien-Smith has for many years been successfully cultivating a very large proportion of the species in the New Zealand flora. There many of them, particularly those from the coastal areas, flourish every bit as well as in their native land. Similar conditions may be found in the Channel Islands and in the more genial parts of Devon and Cornwall. In certain other gardens, too, in other southern counties, notably in that of our President, fine collections of New Zealand trees, shrubs, and other plants may be found. Many of these, however, suffered severely during the last two winters. But it is not very long since the number of gardens in England in which one would find any New Zealand plants, beyond such things as a few Veronicas and an occasional *Olearia*, was very limited.

In the last few years, however, there has been a very marked increase in the popularity of the cult of New Zealand plants. This change in the horticultural taste of England has been largely due to the recognition of the value of many of the New Zealand alpinas as beautiful and hardy adjuncts to the rock garden. For the stimulation of a general interest in the flora of New Zealand the greatest personal credit is due to Dr. Cockayne, the New Zealand botanist. He has been indefatigable in his endeavours to induce gardeners, primarily in New Zealand, to recognize the beauty and value of many of their native plants, especially their alpinas. His little book on "The Cultivation of New Zealand Plants," though written specially for gardeners in that country, is invaluable as a help to any one in England who is interested in the subject. It gives detailed information of habitat and characters, with instructions for culture and propagation of all the species that are worth growing.

CLIMATE.

New Zealand is popularly supposed to have a climate somewhat like our own, but a little better and more genial in most respects. One would naturally suppose, therefore, that any of the plants that flourish, at any rate in the southern and colder parts of those islands, would be reasonably hardy in most parts of this country. Unfortunately, this does not prove to be the case; for, after any winter

other than mild, one must expect a heavy list of damage amongst our New Zealand plants. Even such a thing as the common Manuka (*Leptospermum scoparium*), which is such a nuisance to many farmers even in South Canterbury and Otago, cannot be trusted to survive a moderately severe winter in many gardens in southern England.

In order to find some reason for this disappointing fact I propose to give a short account of the climate of New Zealand as compared with that of Britain.

The word "climate" originally meant the inclination of a particular piece of the earth's surface to the sun; in other words, latitude. Fortunately for us in Britain there are other factors which are almost if not quite as important as latitude in determining what we now mean by climate. If this were not so we could not here expect to enjoy anything more genial than the climate of Labrador. And where then would be our beautiful gardens?

GEOGRAPHICAL FACTORS.

The growth of plants in any land is chiefly influenced by the conditions there as to temperature, rainfall and sunshine; and these in their turn are dependent on such geographical factors as the following:

1. Latitude.
2. Relationship to the ocean.
3. Prevailing currents in that ocean.
4. Prevailing winds.
5. Physical character of the land (altitude, etc.).

I will start my comparison under these headings.

1. *Latitude and Geographical Position.*

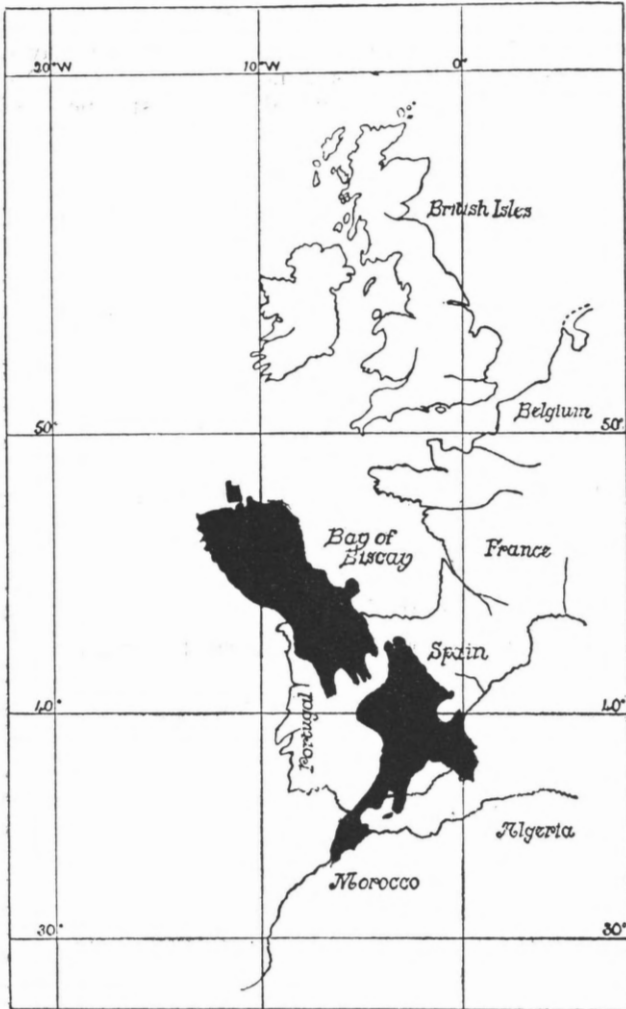
New Zealand consists of a group of islands closely comparable in total area with Great Britain. I used to be taught, as a boy, that New Zealand is a little larger than Great Britain, but a little smaller than Great Britain and Ireland.

New Zealand is often referred to as the Antipodes. This is not strictly correct. For if the exact antipode of New Zealand were plotted out in the Northern Hemisphere (see figure) it would be found that the southernmost point of Stewart Island would lie at a point in the Atlantic about 400 miles due west of the mouth of the Loire and 350 miles south-west of Land's End; whilst the North Cape of the North Island would fall on the coast of Morocco, a short distance west of Fez. The greater part of New Zealand would lie across Spain. This places New Zealand in general about 1,000 miles nearer to the Equator than Britain; were it not for other factors there could be little similarity between the climates of the two countries.

2. *Relationship to the Ocean.*

Both countries are alike in being insular. But the insularity of Britain is to some extent modified by its close proximity to the continent of Europe. New Zealand, on the other hand, is separated from

its nearest continent by 1,000 miles of ocean. This tends to give New Zealand greater equability of temperature than Britain.



3. Prevailing Ocean Currents.

For New Zealand the chief prevailing current is from the west and south-west. The extreme north of Auckland is influenced by a warm current passing southwards between it and Australia. But the effect of this warm current on the rest of New Zealand is nullified by the main cold south-westerly current coming from the direction of the Polar regions.

With Britain, on the other hand, the prevailing current is a warm one, known as the Gulf Stream. This has such a marked influence on

our climate that it brings England, as it were, 500 miles or so nearer to the Equator than its geographical position. And it is along the west coast of Britain that the influence of this current is most strongly felt.

To emphasize the effects of these ocean currents I may say that the limit of floating polar ice comes as near to the south of New Zealand as it does to the north of Scotland. The last time I left New Zealand we encountered a number of icebergs when only two days out from Wellington on the way to Cape Horn; and this was in mid-summer.

4. *Prevailing Winds.*

In both countries the prevailing winds come from the west. But those reaching Britain are likely to have been comparatively better warmed, after passing over many miles of the Gulf Stream. On the other hand, Britain often experiences, in the spring and early summer, long spells of wind from the north-east—wind that is chilled and biting after its passage over the cold territories of Northern Europe and Siberia. We all know too well the effects of these cold north-east winds on ourselves and on our plants.

New Zealand has no adjacent cold territory by which her secondary winds may be chilled. All her winds are ocean winds and therefore the more likely to be equable in temperature.

5. *Physical Characteristics.*

Under this heading we find a very marked contrast between the two countries.

Great Britain is mainly a country of low altitudes. Of England only a very small proportion reaches the height of 600 feet. Even in Scotland and Wales at least half their area must lie below 1,000 feet. The highest mountain in Britain does not reach 4,500 feet. Perpetual snow and ice are unknown in the country.

New Zealand, on the contrary, is a land of high altitudes. Quite a small proportion of the whole country lies at a lower level than 600 feet. The largest area of this low-lying land is that part of the Auckland Province which lies to the north of latitude 38°. Other considerable tracts of low land are found between Palmerston and Wanganui in the North Island, and in Canterbury and south-east Otago in the South Island. Outside these areas the land below 600 feet is chiefly confined to narrow strips along the coasts or running between the ranges of hills. Nearly two-thirds of the whole country must be above the level of 1,500 feet; and in few places could one travel 20 miles from the sea without reaching that height.

Extensive mountain ranges cover a great part of the South and run through the body of the North Island. Amongst these mountains there are 230 peaks exceeding 7,000 feet, and of these sixteen reach to over 10,000 feet, including Mount Cook at 12,350 feet, and there are large fields of perpetual snow and glacial ice. This is a very different story from that of Great Britain.

THE CLIMATE OF NEW ZEALAND.

To give a comprehensive description of the climate of New Zealand as a whole is as impossible as it would be to do so for Great Britain. What description could one give of a climate that would apply equally to Torquay on the one hand and to Braemar or even to Buxton on the other? For our purpose we must divide New Zealand into such areas that the climatic conditions in each will be more or less uniform. The two main groups of these areas will be Littoral and Inland. And here the marked difference in altitudes of the inland parts of New Zealand and of Britain will give very different conditions in those parts of the two countries.

First I propose to give some general details of the conditions in the littoral areas, and then a tabular comparison of the chief features in each.

Littoral Areas.

Area A: that part of the province of Auckland which lies to the north of latitude 38° —from Opotiki in the Bay of Plenty to Kawhia on the west coast. This gives an extensive piece of country about 300 miles from north to south, with its greatest width, about 100 miles, at its southern end. It is almost entirely land of low altitude, and is much intersected by arms of the sea. It is the part of New Zealand chiefly influenced by the warmer northern ocean current.

Its climate is sub-tropical and equable and almost entirely free from frost. This district, besides giving us the Kauri pine, is the home of many beautiful plants such as the Pohutukawa (*Metrosideros tomentosa*), the Whau (*Entelea arborescens*), Rewarewa (*Knightia excelsa*), Toropapa (*Alseuosmia macrophylla*), Waiatua (*Rhabdanthus Solandri*), and *Hibiscus diversifolius*. Any plants whose natural distribution is confined to this area would have little chance of surviving in the open in any parts of this country other than the most favoured localities in the south-west. But many are well worth growing under glass.

Area B comprises the rest of the littoral of the North Island. With this must be included the small district round Nelson in the South Island, for the climatic records from this are almost identical with those of Napier.

Most of this area consists of a narrow strip of coastal land of low altitude. It differs from Area A in being somewhat cooler and less equable; in having occasional light frosts; in a considerable difference in rainfall between the east and west coasts; and in having a much larger share of bright sunshine.

Area C is the narrow strip of coast-line on the west of the South Island. It has an equable climate, somewhat cooler generally than that of Area B. Its most distinctive feature is its excessive rainfall. The average, over many years, at Hokitika is 116.6 inches per annum. But, in spite of this, it enjoys on the average 1,944 hours of bright sunshine in the year.

Area D.—The littoral on the east of the South Island (including the Canterbury Plains) has a light rainfall for New Zealand. It has a much greater range in extremes of temperature, summer and winter, than *Area C.* Frosts of several days' duration and down to 24° F. are not rare.

Area E is the south-east corner of the South Island, and includes Stewart Island. It gives us climatic conditions unlike anything found in other parts of New Zealand. The temperature generally is lower than in other areas, but fairly equable. It has a moderate rainfall for New Zealand. But it has a considerable experience of fog and over-cast sky. As a result we have poor sunshine records of only 1,641 hours for Dunedin and 1,568 hours for Invercargill. This gives a set of conditions as to temperature, rainfall, and hours of sunshine closely comparable with what is experienced at places like Plymouth and Southampton.

Table of Data for above Areas.

	A. Auckland, North.	B. Rest of North Island and Nelson.	C. South Island, West.	D. South Island, East.	E. South Island, South and South-East.
Frost - - -	Rare	Occasional and light	Occasional	Not uncommon, often down to 24° F. and lasting for a few consecutive days.	
Average maximum for warmest month	74° F.	70°-75° F.	67.4° F.	72° F.	66.5° F.
Average minimum for coldest month	46° F.	37°-42° F. East. West.	36.7° F.	35.2° F.	34°-37° F.
Rainfall - - -	45-50 in.	36 in.-60 in.	116.6 in.	25 in.	37-46 in.
No. of wet days per annum - - -	150-185	107-189	186	123	159-190
Hours of bright sunshine per ann.	2,000-1,950	2,481-2,022	1,944	2,087	1,641-1,568

The Inland Areas.

In the North Island, with comparatively small exceptions, the whole inland territory, from East Cape and Rotorua in the north to Mount Egmont in the west and Wellington in the south, is of high altitude, mainly over 1,000 feet above sea-level. It is traversed by considerable ranges of mountains, the highest point being reached by Mount Ruapehu at 9,175 feet.

Meteorological records for this area are scarce. But from those which I have been able to obtain I would estimate that the climate of the less elevated portions of this plateau is characterized by much greater extremes of temperature than the coastal districts. The shade temperature in the summer may be expected often to exceed 90° F., and, in the winter, frosts down to 26° F. would not be rare, whilst snow on the low hills is a common winter sight. The rainfall would be high, 40 to 55 inches in many parts; but less to the eastern side of the high mountains. The annual sunshine record would be well over 2,000 hours in most parts. The higher portions of the mountain ranges

would give us true alpine conditions with very low temperatures in the winter.

In the South Island the inland area is even more mountainous, more rugged, and reaches higher altitudes than in the north. A very large proportion would be truly alpine, rather than merely montane.

The highest ridge of the mountains runs close to the west coast. And its effect is to bring about precipitation of most of the moisture with which the prevailing western wind is laden. As a consequence we have very heavy three-figure rainfall on the western slopes; but a very low rainfall in the country to the east of these first alpine ridges. Thus Tekapo in the Mackenzie country, a little to the east of Mount Cook, though barely 50 miles from the humid and equable west coast, gives us only 19 inches of rain, and records temperatures up to 86° F. in the summer and down to 4° F. in the winter; and, with this, the remarkable record of 2,742 hours of bright sunshine in the year. Similar conditions would probably be found in many other places in this inner part of the South Island.

Winds.

New Zealand is commonly described as an excessively windy place. Wellington, for instance, is boisterously gusty; for here the prevailing westerly winds endeavour to avoid going over the tops of mountain ranges by dodging southwards, between the mountains of the two islands, through the gap at Cook Strait. One used to say that one could always recognize a Wellington man by the way he grabbed at his hat when approaching a street corner. But, taking New Zealand as a whole, I am doubtful of its being very much more windy than Britain. Think of the destructive gales so frequently experienced all round our own coasts. New Zealand would not give us much worse than these; and it certainly does not experience anything like the fierce tornadoes that we hear of at Miami and in many other parts of the world.

Comparison with Britain.

After this very imperfect summary of meteorological conditions that may be met with in various parts of New Zealand I will try to give a short general comparison of them with our own experiences in Britain. But in this comparison I shall leave out of consideration the littoral area that I have described under Area A as having a sub-tropical climate; for we have nothing here to compare with this northern part of the province of Auckland.

First, let me say that the weather in New Zealand is liable to the same quick changes and uncertainty that are the glory of our British climate.

I will make my comparison under four chief headings—viz. *Rainfall, Sunshine, Temperature, and Frosts.*

Rainfall.

There is no definite rainy season in New Zealand; in fact, the rainfall in all parts is characterized by a more even average distribu-

tion amongst the months in the year than in this country. As in this country, the rainfall on the west coast is higher than in the centre or east. But the rainfall along the west coast of South Island is much heavier than anything in Britain, with the possible exception of the remarkable but isolated records from Seathwaite. Over New Zealand generally it would be heavier than in Britain as a whole. In spite of this, the time taken for precipitation of rain in New Zealand is less than in this country. High falls in 24-hour periods are much more frequent. In short, when it wants to rain in New Zealand it set about its job in a businesslike way. With the exception of what I may call the small dull south-east corner, New Zealand knows little of fogs or of damp days and weeks in which, though it is always wet, there is barely half-inch of rainfall recorded in a week.

Sunshine.

As a result of the above businesslike method of precipitation of rain, New Zealand can show us a glorious record of bright sunshine.

Of thirty-one stations in New Zealand from which I have records, all but the two in what I have already called the small dull south-east corner give us records ranging from 44.6 per cent. to 62 per cent. of the possible sunshine in the year. As against these figures, the best records that the British Islands can show are 43 per cent. in the Channel Islands and 41 per cent. at Felixstowe, Bognor and Worthing, whilst many places return records as low as from 21 to 30 per cent. In other words, New Zealand's best place has about 50 per cent. more sunshine than Britain's best; and even the worst of New Zealand's comparatively poor returns shows 70 per cent. more than Scotland's worst.

Add to this the fact that New Zealand is 1,000 miles nearer to the Equator than Britain, and therefore that the sun's rays are there very much more vertical and consequently more potent. It is easy then to appreciate the enormous difference, both in quantity and quality, that there is between the sunshine of New Zealand and that of Britain; and to realize the tremendous effect this must have on the growth of plants and on the hardening of their tissues against the frost and cold of the coming winter and spring.

Temperature.

As far as actual highest summer shade temperatures are concerned, there is little to choose between those recorded in any part of New Zealand and those from many places in Britain. But in this connection we must not forget the unfortunate prevalence in this country of long spells of cold north-east wind in the spring, which often continue till quite late in the summer months. These have the effect of giving Britain a very much shorter spell of warm summer weather than the amount that can be expected in New Zealand.

Frosts.

In the parts of New Zealand that we are considering frosts are fairly frequent. But, except at very high altitudes, these frosts seldom

give a temperature below 24° F. They are usually of short duration. They seldom occur with an overcast sky; so that one can confidently expect warm sunshine on the following day; and this will prevent any cumulative effect of the night frosts. New Zealand knows very little of frosts of 20°, or of frosts which continue for days in damp and overcast weather; or of the late spring frosts, of which we experienced so many even in our last glorious summer, as an adjunct to our persistent cold north-east wind. I am convinced that these late spring frosts, following, as they often do, short spells of warm weather, are more destructive to New Zealand plants than the longer and more severe frosts of midwinter. For many of our New Zealand trees and shrubs, having had no late frosts to contend with in their native land, have a habit of starting into growth very early in the spring. Then their tender new shoots fall easy victims to the later frosts.

FACTORS OTHER THAN METEOROLOGICAL.

Another factor that may help to explain the difficulty that many of these plants have in surviving in England is that a considerable proportion of the New Zealand flora is of tropical or sub-tropical origin. Cut off, as I have already described, from their former northern homes, they had to do the best they could to accommodate themselves to the cooler conditions in which they were placed. It is not difficult to understand that they might not be able to carry that adaptation far enough to survive in the still less genial climate that they find here.

What I have said above refers mainly to plants of lowland or coastal origin. With the beautiful alpine plants of New Zealand, such as *Celmisia*, *Myosotis*, *Ourisia*, and *Ranunculus*, it is not so much a question of temperature; it is rather one of soil drainage, water supply and sunshine. Some species are easy to accommodate, but others are very fastidious. In their native haunts they are accustomed to most intense cold in the winter and hot sun in the summer. Many of them grow in shingly grit, with perhaps some admixture of peaty soil, where there is a constant supply of water; but there must at the same time be very free drainage and aeration at the roots. These conditions may be easily found on New Zealand's wet mountains, but they are not readily produced in our gardens. I am told that in New Zealand gardens the rhizomes of *Ranunculus Lyallii*, brought down from the mountains, will flower well for the first year, but can seldom be persuaded to survive for future seasons.

Conference of Empire Horticulturists.—This will be held in London in August next to fit in with the International Horticultural Congress. Mr. T. L. Lancaster, M.Sc., N.D.H. (N.Z.), will represent the Institute at both gatherings.

Cups and Shield.—The Southland District Council has secured the donation of a Shield and two silver Cups for competition in Southland in the interests of horticulture,

NEW ZEALAND PLANTS CULTIVATED IN BRITAIN.*

BY PROFESSOR ARNOLD WALL, Canterbury College, Christchurch.

Notes on the Winter of 1928-9.

This winter has been even more destructive to New Zealand plants in English gardens than that of 1927-8. Mr. G. W. C. Loder, of Wakehurst Place, Ardingly, Sussex, writes as follows: "Sad as were the effects of the winter of 1927-8, they were trifling as compared with the disasters we have suffered this year. It is safe to say that not since the winter of 1894-5 have gardens suffered so severely, and I am sorry to say that the New Zealand plants have suffered most. . . . The winter was not really a very severe one measured by either the length or intensity of frost—but the damage to vegetation was nevertheless very great, possibly owing to the prevalence of very bitter East wind, and (odd as to may appear) absence of snow. My belief is that there is something particularly pernicious in an East wind in N.W. Europe. . . . Broadly speaking, the *Leptospermums* suffered most; I doubt whether any will recover. Next to them the *Olearias* and *Senecios*; most of them are injured but I expect most of them will recover. The *Veronicas* have suffered, but not so severely as I should have expected. . . . To refer to individual plants—the large plant of *Olearia macrodonta* (which you mention in your paper) has been badly "scorched," and the leaves are falling off, but the plant is quite alive. *O. ilicifolia* seems more tender—also *O. nitida*—but both will survive. *Fuchsia excorticata*, badly cut, but will break low down. *Panax arborea*: several plants severely injured, but all will, I think, recover though disfigured. . . . The only *Nothofagus* to suffer at all severely is *N. Solanderi*. . . . *Podocarpus Totara* uninjured, also *Phyllocladus trichomanoides*. *Senecio Monroi* has come through best of the *Senecios*; *S. Greyii*, *S. laxifolius*, and *S. compactus* all look as if they had succumbed, but may break.

"Our severest frost here was 21 in the screen (i.e. 11 Fahr.). It went lower in the winter of 1916-17, but not so much damage was done that winter. Broadly speaking, it seems that New Zealand plants will stand about 10 degrees of frost in Sussex, but when it comes to 20 degrees we must expect losses, especially if accompanied by exceptionally cold East winds."

Dr. A. H. Williams, whose garden is also in Sussex, near Horsham, writes as follows: "We are just emerging from the most destructive winter that I remember. . . . I have lost, I should think, four-fifths of my New Zealand things. . . . At Tresco (Isles of Scilly) they have had no frost. . . . all looking very happy and well; but on the mainland in Cornwall and Devon I saw great *Cordylines* of considerable age quite ruined and cut to the ground.

*Extracts from an article published in the *Transactions of the New Zealand Institute*, vol. 60, pp. 379-393, 1929. (By permission).

"Of my *Veronicas*, *H. buxifolia*, *H. vernicosa*, *H. cupressoides*, *H. Allanii* have come through untouched; but all the others have been hit hard and the subtender ones like hybrids of *H. speciosa* that have survived hitherto were killed outright—even *H. Traversii* was badly hit. Of *Olearias*, *Colensoi*, *macrodonta*, *Solanderi*, *Forsteri*, and *arborescens* have been killed outright. *O. ilicifolia*, *semidentata*, and *moschata* had been killed in the previous winter, but *O. Haastii*, *aviccenniaefolia*, *oleifolia*, and *nummularifolia* were untouched. *Pittosporums*, *Colensoi*, *eugenioides* and *tenuifolium* (and vars.) have been cut to the ground or killed outright, but *Buchanani* (?), *crassifolium*, *Ralphii*, and *Dallii* have stood it fairly well and may recover. It is odd that *crassifolium* and *Dallii* should appear to be the hardiest of them. *Senecios*, *S. compactus* killed outright. Most of the plants of *Huntii* killed and *laxifolius* and *Monroi* badly hit. The *Carmichaelias*—all except *C. nana*—very badly hit or killed. All my *Manukas* and many of the *Cassinias* seem to be dead. . . . As to the cause of all this: In January we had about a fortnight of frost of about 20 degrees. As a rule our severe frosts end with a real thaw and rain. But when this frost broke we had no real thaw, but warm days with bright sunshine alternating with frost nearly every night of from 5 to 10 degrees and no rain. This sort of thing has continued from January to the end of April. . . . With this dry alternation of hot days and cold nights one by one the plants seem to have given out."

INSTITUTE NOTES.

Patrons.—Their Excellencies Lord Bledisloe, Governor-General, and Lady Bledisloe, have been good enough to accept the offices of Patrons of the Institute during their term of office in New Zealand.

Text Books.—Johnson's "Gardeners' Dictionary" has been approved as an alternative to the books formerly recommended for the guidance of students.

Diplomas, etc., Granted.—Since the issue of the March Journal there have been granted 5 Diplomas under "Group C"; also the first Junior Certificate issued (to Miss B. E. Martin, Dunedin).

Fruit Nomenclature.—A committee consisting of representatives of (a) the Department of Agriculture, (b) the Department of Scientific and Industrial Research, (c) the New Zealand Fruitgrowers' Federation Ltd., (d), the New Zealand Fruit-export Control Board, (e) the New Zealand Horticultural Trades' Association, and (f) this Institute, has been set up to deal with this matter.

Recording of New Varieties of Plants.—The Institute has now decided to undertake this work and a committee has been set up to arrange details.

HORTICULTURAL SHOWS:

AUCKLAND HORTICULTURAL SOCIETY.

President: Sir Edwin Mitchelson, K.C.M.G.
Secretary: c/o. Box 124, Auckland.

Daffodil Show: 18-19 September, 1930.

Summer Show: 4-5 December, 1930.

Dahlia Show: 12-13 March, 1931.

Chrysanthemum Show: 23-24 April, 1931.

WELLINGTON HORTICULTURAL SOCIETY.

President: Dr. Arnold Izard.

Secretary: J. G. MacKenzie, N.D.H. (N.Z.), c/o. Town Hall.

Spring Show: 24-25 September, 1930.

All shows held in Town Hall, Wellington.

HUTT VALLEY HORTICULTURAL SOCIETY.

President: D. S. Patrick, Esq.

Secretary: A. J. Nicholls, P.O. Box 19, Lower Hutt.

Spring Show: 17-18 September, 1930.

All Shows held in King George Theatre, Lower Hutt.

MATAURA HORTICULTURAL AND INDUSTRIAL EXHIBIT SOCIETY.

President: J. L. Mitchell Esq.

Secretary: James Ingram.

Annual Show held in Society's Hall, Balclutha, in February.

New Zealand Institute of Horticulture (Inc.)

Patrons: Their Excellencies LORD BLEDISLOE, Governor-General, and LADY BLEDISLOE.

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