

PART I.

LEAF CHARACTERS AS DIAGNOSTIC FEATURES.

1. INTRODUCTION.

The possibilities of a Citrus industry in the West Indies have been attracting much attention during the last year or two. This was marked by the action of the Empire Marketing Board in sending out Professor H. Clark Powell of Transvaal University College to examine the state of grapefruit culture in the West Indies. His report ⁽¹⁾ is optimistic and very much in favour of an earnest effort to establish such an industry on a sound basis. In Trinidad, with its large areas of fertile soil, there is much land which could carry citrus fruits to good advantage, and areas of crops not paying at this time could be replaced by citrus. The West Indies are in a more favourable position compared with California and other large grapefruit producing countries in that they enjoy a preferential tariff for their fruit in Canada and Great Britain; moreover there is a fast direct steamship service between the islands and Great Britain which would obviously tend to land the fruit in England in a better condition than that which has been longer in transit. Again labour is cheap, rainfall good and transport facilities generally excellent as compared with such difficulties instanced by Professor Clark Powell in Texas and California - low rainfall, high priced land and expensive soil fertilisation.

One of the chief needs for success in forming this industry is the orderly production of fruit easily graded and standardised. To capture overseas markets it is essential that buyers may know they are certain to receive such and such a class of fruit whenever a shipment is taken. In order that this may be accomplished very few and definite varieties of fruit must be grown, and the treatment such varieties receive in the orchard will influence their value as a grade and in effecting standardisation of such grades. Now it is a well known fact that the

greater part, if not all, commercial citrus plantations consist of budded trees. This has arisen from several causes the chief being the heterozygosity of citrus seedlings with the resulting uncertainty of yield and quality, and the greater hardiness induced by the use of proper rootstocks. The rootstock most universally used is the sour orange (*Citrus aurantium*). The value of budding limes on sour orange was first mooted in 1914-15 and the preceding year's experiments on that point were reported from Dominica.⁽²⁾ While such budding increased the price of the plants, the trees were found to be vastly superior in their resistance to root diseases. Moreover, sour orange trees themselves withstood a hurricane at that time, while limes on their own roots were blown down. At the same time Citrons were tried as stocks, but while giving great resistance to root diseases their shallow rooted nature was a disadvantage.

Other things being equal, the factors most influencing the trees in different populations are the characters of the rootstock and budwood. In order that a uniform product may be obtained together with highest yields, very careful selection of budwood and rootstock must therefore be made. The budwood is more easily selected than the rootstock since it can be chosen from trees known to be of desirable constitution. But in the choice of rootstocks one is faced with the problem of the heterozygous nature of the seedlings and its effect on the inter-action of the stock and scion. A citrus stock proving to give a desirable type of tree cannot be propagated vegetatively for the very fact that one has had to produce the budded tree before its action can be appreciated. By then any part which might be used for vegetative propagation consists wholly of scion wood. It is thus necessary to use seedling plants for stocks - besides which it is a far quicker, cheaper and easier method of obtaining a number of stock plants. But such seedling stocks will be capable of affecting any one of a number of characters in the final tree. The problem is to be able to tell those strains of any one stock which will have the desired effects upon the scion and produce trees of the required quality,

yield and general usefulness. The stock can affect the shape of the tree - dwarf, half or full standard, its period to maturity, as well as the power to resist diseases and drought. Not only must it be possible to tell a good stock, but such differences must be visible at an early stage of the seedling's life, so that early elimination of undesirable seedlings may be carried out.

Variation in the behaviour of individual seedling stocks when budded with grapefruit is very great. Some enquiries were made at the California Citrus Experimental Station ⁽³⁾ into the history of such stocks of sweet orange which showed great differences in their preliminary vigour of growth. It was noticed that seedlings used for budding in propagating citrus fruits showed great variation in size throughout all stages of growth. At the time when certain seedlings were ready for planting out there was a range of height from 18" to a few inches only. After selection of the tallest and budding grapefruit on them, there was still a segregation into different sizes and about 15% of budded trees made poor growth. Such trees were discarded in the experiments carried out to test the large, intermediate and small budded trees which had resulted. After two years of growth in the orchard, four varieties of budded trees being under observation, the large trees in all cases remained large, the intermediate, intermediate and the small, small. From trunk measurements each group was shown to be about two years behind the others, the large being ahead. Such results are comparable with the dwarfing, half standard and standard effects obtained from different Paradise Apple stocks at East Malling and it is probable that citrus problems could be worked out along such lines with much success. Work on such lines would have to be done with several varieties and species of citrus, as the stock best for one fruit is not necessarily the best for another. Thus, for Navel oranges and grapefruit, sour oranges are best; for lemons, a pomelo stock is good. Other stocks which may be used are sweet orange and trifoliate dwarf lemons.

The most important work on the selection of rootstocks and their classification must be attributed to the East Malling research station in Kent, where during the past twenty years they have evolved certain stocks for apples the behaviour of which with different scions and certain conditions of soil and cultivation is fully known. Thus a stock may be supplied which can be certified to give a dwarfed tree when budded with certain scions. Another will give a different quality fruit with some definite scion. This behaviour of the stocks has now been correlated with a number of external characters, among which are certain leaf characters. It has been found that the leaf measurements, their size and shape and other characteristics are all correlated with that behaviour.* This can be shown at an early stage and any plants with undesirable or doubtful characters can be excluded from nursery work immediately, thus cutting down the number of plants in the nursery, reducing the chances of misfits between stock and scion and generally giving a more economic working of the orchard.

It is hoped eventually to arrive at such a method with citrus fruit stocks, but a great deal of preliminary work will have to be done to find those characters which are definite and typical enough always to indicate one desirable strain. From the few investigations reported in this paper it is hoped to indicate certain lines of approach, and to put forward one or two characters which seem to be constant in any one strain.

termed the "leaf index" - varied from the bottom leaves upwards. It became necessary, there-