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RETROGRADE SELECTION.

I should be grateful if any of your correspondents would kindly give advice on the details of an experiment I have in prospect. Suggestions are more especially desired as to the most suitable plants for the purpose.

The experiment is intended to be carried on by a process of “backward selection,” or in the opposite direction to that followed by breeders, whether of plants or animals, when they attempt to create a new variety. They select for the parents of each coming generation those individuals of their experimental stock, whose characteristics approach most nearly to the ideal type pictured in their imagination. My aim is the very reverse of this: it is to begin with a variety that has become established, and to breed back to the original form. The primary object is to learn the number of generations that must elapse before the original form is reached, under specified conditions of culture and selection. By this process it is hoped that a practical means of measuring the stability of strains, varieties and races, may ultimately be discovered, and that more light will be thrown on the steps through which changes of type take place, and that many matters of high theoretical importance may be cleared up, relating to the distribution of variations and to the varying degrees of continuity or discontinuity in regression, which are too technical to be discussed here.

Whatever may be ultimately done in this direction, it is certain that exact ideas of the characters should be conducted under the easiest conditions, and especially by employing the plant that seems best adapted to the purpose. The principal difficulty is that the annual, in extensive cultivation, consisting of an original race, and of a distinct and well-established variety that has been recognised for a considerable time. Also that the plants, both of the original race and of the variety, should admit of being grown in a healthy state, in small flower-pots. It would further greatly facilitate the experiment if the main difference between the race and the variety lay simply in their size, the one being a dwarf form of the other. Anyhow for the first trial, a plant ought to be employed in which the differences are, in some way, strictly measurable. Units of length are serviceable for height of plant and for breadth of leaves, &c.; units of number, for number of leaves, spots, serrations, &c.; units of time, for period of sprouting, budding, &c.

The first enquiry that I make is, What plants best fulfil the above requirements? Next, as to the soil in which to grow them, for the tendency of a variety to relapse into its original form greatly depends on the character of the soil. These and other difficulties to be fulfilled. The first is, that whatever soil be employed, its quality should admit of clear definition, so that the experiment could be simultaneously carried on by different persons, and be hereafter repeated under precisely similar conditions, so far as the influence of one element is concerned. The second desideratum is not immediately felt, as it relates to the possibility of future experiments of the same general character. There are numerous different plants, in which case it would be easy to employ a limited number of different and well-specified soils, or perhaps only two of them, a light and a heavy, with possibly the occasional mixture of some definite dose of a chemical ingredient. A reasonable method of meeting the difficulty would be to obtain the soil for their horizontal and chemical peculiarities. Therefore, the second enquiry that I make is, What well-defined soils would be suitable for these experiments?

There are many other details of procedure that require to be determined, referring to mode of planting, exposure, watering, avoidance of accidental injury, &c., but no doubt they could be clearly systematised on a carefully-considered plan, so as to ensure uniformity of treatment by different experimenters, but I will not at present ask particulars.

Assuming that we have fixed on a plant of the original stock n, and on its variety v, severally planted in suitable and specified soils, and that the experimental series x, planted in the same soil as n, is intended to change v back into n, the proposed experiment would be something of the following form:—There would be a few, say a dozen, specimens of both n and v, and fully 100 of x, I hasten in a separate flower-pot, requiring the use of some 124 pots altogether. n and v would be annually raised from seeds procured from the same seedsmen, to serve as references, for they and the experimental set would be equally affected by the varying peculiarities of the climate, &c., in different years, as well as by the permanent environments of the locality.

For simplicity of explanation, let us suppose the noticeable difference between n and v to consist in their height at the time when they are sown, it being supposed that this could not be altered. Also that the change backwards occurs gradually, and not by sudden jumps on the part of individual plants. Some days before the experimental series x is to be provisionally sown, the attempt would be made to so arrange the pots that the plants shall stand in ordered sequence, beginning with the shortest, and ending with the tallest. The pots of n and of v would be arranged on the same principle. When the buds begin to show, the orderly arrangement of the three sets would be carefully and finally revised, and the class-place of each plant in its respective series would be chalked on its pot, No. 1 signifying the longest place. Consequently the two middlemost of the x series would be 3 and 4, the two middlemost of the v series would also be 3 and 4, while those of the x series would be 59 and 51. A single class-place makes little difference except towards the extreme ends. The next step is to see by direct comparison whether n 3 or 4 coincides in height with any one of the v series, placing them on either side of n if possible. The first year, the price comparisons to the table of the 3 n would be the tallest of the v set. In that case, set aside the, say, five tallest of v, viz.: Nos. 50 to 54. Next, the second place of the n would be high off from every other plant of the lot, so that no risk of cross-fertilisation may subsequently arise, while a sufficient number of seed-plants are preserved to avoid the injurious effects on their offspring of close inter-breeding. Or it may happen, if not in the first year, then in some subsequent year of the experiment, that a match to n 3 or n 4 may be found at some particular class-place in the x series, say at the 80th class-place. Then keep Nos. 76, 79, 80, 51, 52 for seed, and destroy all other buds as before. In all cases, make an exactly similar comparison between v 3 and v 4 and the x series. Lastly, obtain a photographic record of all the three series of plants, x, n, v, by putting the pots in orderly arrangement, with their chalked sides foremost, upon a five shelve fixed to a vertical wall, twenty-five square niches in front of them, the whole can be photographed on one plate, without distortion. Tapes of inches, or the like, should be fixed to the forehead to give the scale of the photograph.

By these means every desirable measurement of the plants admits of being leisurely made by the statisticians, who will treat his measurements according to modern methods, and deduce the required information from them.

Proceeding year after year in this way, the mean height of x will increase, but it would be undesirable to wait until the middlemost of x closely coincided with the middlemost of n. The increase in height of x may be very rapid during the earlier years, but will become gradually slower as length so slow that close coincidence will not occur for a long time; and, again, when it does so, the precise epoch could not be determined with confidence. It would be better to complete the experiment at an earlier stage. That which I would propose is the first year on which the x-plant, which occupies the 81st class-place, in a series of 100, coincides in height with the middlemost of n. Technically, this would be termed the “upper quartile” x-plant, because it stands one-quarter of the way down from the top of the class. The height of the upper quartile plant (as of occupying any other specified class-place), is independent of the number of plants in the series, so long as they are sufficiently numerous for statistical purposes. The upper quartile is very easily ascertained, whatever the number of the plants in the series may be; it is simply determined by the formula n 3 or n 4, and is that one which plays an important part in the higher methods of statistics. Had v been a large variety, and not a dwarf variety of n, the lower quartile, or the twenty-fifth plant in a series of 100, would have been employed.

It is hardly necessary here to speak at length on such changes of the process as would be needed in the very probable event of some few of the x-plants making a sudden change to n, because the reader can easily foresee them.

The process just described, except the photography part of it, is not restricted to single and measurable characterisation, but is generally applicable, so long as the individuals admit of being classed in orderly series, and massed by measurements, by comparison, or by marks awarded according to the judgment of an examiner. Thus, when plants, or animals, are divided in their year or year of the x-plant, the groupings have to take simultaneous note of numerous "points," and to give their marks and classify accordingly, and they do so with the precision, as shown by the 31 31 31 31 31 for the judgments of different experts. Therefore, although the measurement of a single character and the
THE GARDENER'S CHRONICLE.

New Varieties of Fruits.

The report of the Pomologist of the United States Department of Agriculture for 1905 has just been distributed, and though as tardy as any Government document, it is worth notice. As usual, the matter of greatest importance is the report on "Promising New Fruits," under which head are described the various Apples, Pears, Peas, &c., which have been recently introduced and brought to the notice of the Division of Pomology. The list includes 100 varieties of Apples, mostly in the new, 12 varieties of Pears, 3 of Apricots, 11 of Cherries, 5 of Peaches, 17 of Plums, 2 of Grapes, 6 of Oranges, and 1 of Pomelo. This report contains the information that the American fruit list is increasing with all desirable rapidity. Of course, these records represent a very large number with many very diverse conditions, wherein a considerable number of these varieties achieve only a local importance. But it is easy to see that our fruit list will soon become so tremendous as to frighten the conscientious mind of the connoisseur and a complete revision of Mr. Downing's book has already become an impossibility. It may also be seriously doubted whether the further introduction of new varieties, especially to the Apple list, is worth while.

Of the introductions in question, two of the varieties are of particular interest. One is a new variety of Four of China, and the other is the Russian or Polish origin. A great deal has been said in recent years about the addition to the American fruit list from the Russian introductions; but it is not at all clear that these represent with fair accuracy the relative importance of those introductions. The Russian fruits are making considerable inroads in the Cherry list. The Russian Apples are gaining some attention in very cold sections of the States and the Dominion, while the Russian Plums remain practically confined to the low and moist situations.

A strong fruit is being made at Washington against the large forest reservations made by President Cleveland at the last day of the administration. The Cattle-men and miners, railroad men, and many other private interests with which the reservations interfere, are bringing every political influence to bear on Congress to have the President McKinley and his Secretary of the Interior made to rescind. It seems probable that the present time is one when some concomittances of modifications may be made in the executive proclamation of reservation, but it is hoped and believed that no general abrogation of the order will be attempted. F. A. Waage, Washington, April 28.

AMERICAN NOTES.

Methods of Propagation.

(Continued from p. 315.)

Composts from Seed.—If only a few trees or shrubs of any kind are required, and it is desired to raise them from seed, sow the seeds in boxes or seed pans, and place them in a cold pit, where they should be watered as often as necessary. Transplant the seedlings into the pots as soon as they are large enough, and thus prevent the roots becoming curled together. Composts are always best when raised from seed; they can then develop naturally to the scale pyramidal form, that makes these trees so useful to the landscape gardener. When planted for ornamental purposes, they should never be crowded, but if grown for timber only, it is necessary to plant them closely, as they draw one another up, as it is called, and may be thinned out when they reach the desired height. For merely ornamental purposes, or for making topiary trees, it is better to use many smaller trees, "stool," or throw up young growth from their roots. The cones generally do not attain maturity till the second year after forming. The structure of the wood is, as with nearly every species of pine under the microscope, is unique, the pitted cells, which are always present, determining at once that the tree from this section has been a Conifer. The most important northern timber trees belong to this order, but a few are only grown largely in this country as forest trees, the great bulk of the Pinus being imported from Norway and Sweden, from Canada, and other parts of the New World. But the seed of some species is imported from Asia, and may be profitably employed to grow this class of timber. The seeds of all the genuses are securely imbedded in the cone, and require a long time to germinate. The cones should be collected in late autumn, and stored in a dry warm place, boxes, such as those used for the hot-water boiler, where the temperature is regular and dry. Thus treated the scales of the cones will open, and the seeds will generally be freed, if the cone be taken in the hand and struck sharply against a wall or some hard substance. Having freed the scales and aborted seeds, the rest may be sown in light peaty soil, in an outside pit, protected in bad weather by cloths or other movable lights, or if this is much quantities the seeds may be sown at

Quelegias.

There are not many flowers that possess higher qualities in both their cultivation and their effects. I am greatly surprised that their culture should be comparatively limited in Southeast Asia, where they can be propagated so easily and so profusely. They are among the most hardy. Vigna rosea, for instance, is one of the hardy and vigorous, if not abundant in flower, and as they do not require much attention, they are extensively cultivated in the gardens of Southeast Asia, and are often seen in profusion in the flower beds of the royal palaces.

The effects of the flower pots in different positions, may readily be noticed in the early experiments, a much wider field of work lies open to the future, after the practicability of the simplest and most direct method has been assured.

I am not unreasonably pessimistic of the shortcomings of the too brief sketch of the details and of the full purport of the experiment in view; but I find it all the same, because it adequately explains why the most destructive of all the weeds, and because a complete explanation would take much more space, and be necessarily very technical. Should further information of the latter be desired, I would refer to a paper and calculations just published by myself in Nature, April 29, p. 605, which I worked out with reference to one phase of this very topic.

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