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The Madras Agricultural Department.

We welcome the appearance of the Notes recently prepared by Mr. Chadwick on the origin and development of the Department. If it is true that happy is the nation which has no history, the Madras Agricultural Department must in the past have borne more than its share of affliction, for Mr. Chadwick's narrative pictures its varied career, and the frequent changes which its centre, the Saidapet College, was made to undergo.

We are often told that Saidapet was a failure, and this is largely true, but the lessons to be learnt from its failure are many, and we are thankful to Mr. Chadwick, firstly for his clear statement of the causes, many of them not on the surface obvious and easy to see, of this failure, and secondly for his sympathetic treatment and real appreciation of the benefits which the Department at

present is enjoying as the result of the workers at Saidapet.

There are four of these notes, of which the first two will appeal specially to the older members of the Union, since they deal (i) with the general history of the Department and (ii) with the early efforts to develop agriculture with notable results obtained and the causes of failure. The historical sketch of the Department traces clearly the incessant changes due to the varying policies that prevailed at different times. The author divides the period 1866-1896 broadly into three decades, the first of which was characterised by the ascendancy of the idea of a model farm worked on western methods; the second decade was dominated by a barren discussion on agricultural education, the third was doomed to fall a prey to agricultural statistics. The note shows how each of these ends, though excellent in itself, yet failed to produce much tangible result when overdeveloped to the exclusion of the others, while the absence of any attempt at investigation, local enquiry or scientific research was fatal to any real progress. The second note deals more in detail with the various lines of work taken up and the reasons why they failed to produce any result commensurate with the money and labour spent on them. The most obvious reasons are said to have been the utter inadequacy of the staff, and the lack of knowledge of local conditions and facts. The heads of the Department responsible for the initiation of policy were too much tied to headquarters; it is with amazement that we learn that Mr. Benson did not get away on a district tour for more

than five years after he joined service. Such seem now to be obvious mistakes, but we must remember that it is only Saidapet experience which makes them obvious, and there is no doubt that the lessons learnt in Madras during these years of comparative failure have been of immense benefit. The Madras Agricultural Department has a tradition dating back many years, and Mr. Chadwick pays a kindly tribute to the assistance which the Saidapet men have given and are giving in setting the reconstructed Department on its path of success.

Improvement of Crops.

Systematic breeding of cereals has long been practised in all European countries and America. Recently, considerable amouut of work has also been done in India in wheat, a very important cereal of Northern India, towards the improvement of local wheats by selection and crossing. There are two methods by which improved and new varieties may be obtained, namely 1. by *selection* and 2 by *cross breeding*.

Selection.—A renowned authority on plant breeding states that "Selection is the surest and the most powerful instrument man possesses for the modification of living organisms." It consists merely in the choice of the best individuals for the propagation of seed and it is by means of selection exercised through centuries that our cultivated plants have attained their present standard of excellence. Selection in its general sense is practised by every farmer, when he chooses the best variety suited to his soil and climatic conditions and reserves the best portion of his crop for seed. Selection in livestock is understood, appreciated and put into practice more than in the case of crops. Wherever possible, special care is taken by every ryot in choosing the best bull for his cow that he might get the best calf out of it. In the Central Farm we see dozens of animals being

brought almost every day for service by ryots from adjacent villages. Similarly a plant breeder should take the greatest amount of pains in selecting the variety of crop for his land, in selecting his seed, and in selecting the plants whose produce is to be used as seed.

That there is necessity to choose a variety for one's land is now understood by every farmer as the difference in yield between two varieties grown on the same farm under similar conditions side by side is sometimes sufficient to pay the cost of production. Carefully conducted experiments in every country demonstrate that it pays a farmer to give careful attention to the selection of his seed. Good plumpy grains used as seed are always found to be better than thin and light grains i. e., the higher the specific gravity of a grain, the better it is for seed purposes.

Now the term selection, in its restricted meaning, has a technical significance and implies the systematic choosing of specific plants for future reproduction, with the object of bringing about an amelioration of type. It recognises that there are endless variations in type in an ordinary crop and no two plants are alike. Selection seeks to isolate those types of plants which approximate most nearly to the ideal and to choose systematically from the produce of these types the variations which are likely to be of material value. This is the manner in which most of the improvements in our crops have occured. Several desirable modifications have been effected in some plants through long years of cultivation as in the case of the cabbage (for leaves), the cauliflower (for inflorescence), the mango (for sweet pulp and diminution of seed) and the orange (for internal hairs). These modifications are due not to the attempts made by the grower to evolve these specific forms but to the long continued selection of variations which were considered desirable. An instance in which improvement has been effected from systematic breeding work is the common beet which contains about 7% of sugar, but has been developed into the sugar beet containing about 20% of sugar.

Selection is of two kinds :—1. Mass selection and 2. Individual selection.

Mass Selection consists of the continuous and repeated selection of a number of the best grains, best ears or best plants. It is supposed that, by the repeated selection of a number of good plants each year, the race as a whole will be gradually improved. As to the efficacy of the method, there has been difference of opinion even among famous breeders like DeVries and Fruwith. Mass selection has been found to be most effective when the individual plant is made the unit of selection and not the individual grain or ear, for, it may sometimes happen that large ears are formed on comparatively poor plants. Mass selection tends towards improvement of the type, as only the best plants are taken for propagation, excluding the rest. It may happen that the plants we select, are better than others on account of some favourable environment, such as their having received more manure than others as a result of uneven distribution of manure in the field or having been given more spacing than others. However, the repeated and rigorous selection of the best plants would gradually confine the choice to permanently superior plants, and the general character will improve in the desired direction. It is this method of selection that has been practised in all German Experimental Stations with great success. This method, to be completely effective, must be continuous and uninterrupted i.e., the selection must be kept up every year to counteract any tendency on the part of the plant to degenerate.

Method of doing Mass Selection:—The crop is carefully inspected at harvest time and a sufficient quantity of the best developed seed from robust and prolific plants is collected. This is grown separately next year in a small plot known as the stud plot. At harvest time selection is made in this stud plot and this is used as seed for the stud plot of the succeeding year. The balance is collected and sown as a seed plot in a large area for the year and the harvest of this becomes the seed for the whole of the farm in the third year, i.e., the selection of the stud plot in 1915 is used for the stud plot of 1916 and the balance used as seed plot of 1916 which becomes the seed for the whole farm in 1917. Thus after three years, the selection becomes automatic. The full effects of the process will be felt only at the end of three years, the time taken by the stud plot to become the bulk plot. Thus we see

that there is no complication about this method and it can be effectively applied by all farmers to improve their crops. It must be only continuous and uninterrupted.

Individual Selection:—When the individual plant or ear is made the starting point we have what is known as individual selection. It consists simply in isolating individual plants of promising appearance and multiplying the seed of their types as rapidly as possible. There is but one initial selection followed by rapid multiplication of the progeny. Here the selection begins with a number of superior plants of a variety and the seeds from each plant are separately planted and kept under continued observation. This enables a strict comparison to be made of the progeny of each selection so that in a few years the best strain of the original selection may be determined and multiplied for future use. This method assumes that repeated selection is unnecessary.

Another example of individual selection is that adopted by Hays, founder of the American Genetic Association. His method consists in isolating the most promising types of plants in a crop and testing the efficiency of the selection by comparing the prolificacy of a definite number of plants, say 100, from each of the strains so isolated. The total produce of 100 plants in each strain is taken as a measure of the prolificacy of that strain. A great majority will give only an average yield, a few a very poor yield, and a few give an exceedingly high yield and it is these last that are used for further selection. This method is better and more effective when we want an increase in the prolificacy of a given variety rather than an improvement in some specific quality.

Individual selection is more complicated and requires elaborate records and trials for its successful application. This is generally done only in Experimental Stations. In attempting an improvement in a given strain by any of the methods described above, care must be taken to avoid choosing those plants which are better than their neighbours by accidentally favourable circumstances, as more manure, richer soil, more spacing etc., and this requires considerable judgment on the part of the grower.

The second method of effecting specific improvements in plants is by cross breeding or hybridisation. The method is to cross two varieties possessing divergent characteristics and selecting from the widely varying progeny those particular individuals which possess in the highest degree the specific qualities which we are seeking. This kind of work can only be done by a scientist and is beyond the possibilities of an ordinary cultivator.

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Jaggery Making at Kunigal.

A pleasant and interesting excursion was recently made by the writer to see a power mill and jaggery boiling plant erected at Kunigal, a village some 45 miles from Bangalore. The improvement consists mainly in the furnace which is so constructed as to possess a high heat efficiency and obviate the necessity for using extra fuel. The pans are arranged in batteries of three, with a fourth reservoir where the juice can be stored. The highest pan, which gets the least heat, is just at the boil; the middle pan receives enough heat to keep boiling briskly, and it is calculated that here about half the evaporation is done before the juice is run into the third pan, where it is finally boiled down to the right consistency. This last pan can be tilted up by means of a pulley and chain, and the thick juice run out into a wooden box from which it is poured into the moulds. The process is thus continuous, a pan being taken about every hour from each battery. Each change of juice fills the pan to a depth of about 5 inches, and the weight of jaggery produced is about 125 lbs.

At Kunigal, at present only one pair of batteries has been erected, though it is calculated that to keep the mill steadily and continuously at work, there should be two pairs. The mill is driven by a 12 H. P. Oil Engine and is a three roller mill of 18 inches width, giving a very good percentage of extraction.