AN AGRO-BOTANICAL PROBLEM AFFECTING THE SUGARCANE INDUSTRY IN INDIA

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For a proper understanding of the suitability of a particular type or variety of sugarcane to its environment and for achieving under a given set of comparatively unalterable conditions the maximum output, it is necessary to take into account certain agro-botanical and physiological characteristics of the type in relation to the environmental factors. Although the basic requirements of the crop are more or less the same wherever it may be grown, and although sugarcane is a fairly adaptable crop, yet, considering that different types of cane are grown in different soil/climatic tracts of the world and the hybrid genetic composition of these is made up of different proportions of different species or ecotypical races, it may well be expected that the reaction of the different varieties to a given environment will be different and not in all cases can we be sure that the type grown is wholly suited to the tract in which it is growing or that it cannot be improved upon.

The subject of the response of the cane crop or plant to various environmental factors has received a great deal of attention in certain countries. Following upon the useful work done in Java and Mauritius on the form, composition and development of the cane plant and crop, the Hawaiian workers have conducted extensive studies on its responses to the environment, even though the differences in the environment obtaining under their insular conditions were perhaps comparatively smaller than in the continental areas. Interesting contributions have also been made to these aspects by other workers. The scope of such studies has been widened in recent years by the work of Brandes and his associates, who have taken more or less a global view of the problem. While the Hawaiian researches were almost entirely directed to increasing the output, the subject is now becoming important in another direction bearing on the adaptation of hybrid-varieties to the environmental conditions of the sub-tropical areas.

An impetus has been given to breeding work for the sub-tropical areas through the discovery of new races and species of plants allied to sugarcane. With the collection of clones of various species of wild and cultivated sugarcane, the prospect of breeding for different soil/climatic
tracts is bound to be greatly enlarged; considering the possibilities of this comparatively little known breeding material against the background of the available knowledge on the responses of cane crop to environmental factors, it is perhaps possible to visualise that the best utilization of these genetic stocks can be made when the differential response of these widely assorted stocks to the diverse environmental factors is studied and understood. It is possible to expect that with such a knowledge, the breeding and selection work can be placed on a more sound footing.

Such a view is perhaps implicit in the recent transplant experiments conducted by Brandes to find out the growth responses of different species and races of plants allied to sugarcane to environmental differences brought about by latitudinal displacements from natural or "normal" latitudinal locations of each one to that of each of the others. In these studies the main factor studied is day-length, a factor which is found to affect not merely the flowering but also the proliferation and growth sequences of the plant. Besides light, however, there are certain other factors such as temperature which affect cane growth not only quantitatively, but also perhaps qualitatively by modifying the proliferation-pattern of the plant and affecting the more intricate processes controlling the activities of the plant.

In a manner of speaking, this problem of the response of different canes to different environments has been ever present in India, where sugarcane has been grown from time immemorial in tracts characterised by marked differences in soil-type, temperature, rainfall, atmospheric humidity and the range of diurnal and seasonal variation which is more in some places than in others. These soil-climatic tracts have also had under cultivation more or less different types and species of sugarcane with marked differences in agro-botanical characters. A considerable amount of information on the agro-botanical differences between these types has been bequeathed to us in the well-known studies carried out by Dr. Barber, but although the differences between the types are interesting and their taxonomic basis has been confirmed to some extent by counts of chromosome numbers, strangely enough their association with the soil-climatic tracts is not very close and neither the association nor its exceptions have been fully understood. Possibly this is due to the effect of human selection and artificial displacements of types through the exchange of clones. Since then these species and types have been replaced by hybrid varieties. The success of these latter has temporarily masked the need for studies on the response of cane to environment and for a knowledge of the agro-botanical characteristics in relation to the climatic tracts. From the varietal aspect, for the immediate needs
of the industry it has been generally sufficient to find a cane and a successively better one which can grow and yield sugar under given combination of favourable and unfavourable environmental factors. But with a basic knowledge of the precise relationship of the characteristics of different types of cane to the various environmental factors, we might not only understand the nature of the genetic stocks better and thus improve our hybrid material, but also make rapid progress in varietal selection and adaptation.

The importance of this problem has been recently 'highlighted' by Leake. To illustrate the diverse response of the cane plant to environmental conditions, he instances the differences in the nature and sequence of growth and proliferation of cane in the tropics and sub-tropics. While much of this difference is known to be accountable to certain specific environmental conditions, it is possible that the various races and species of sugarcane—wild and cultivated—have their own proliferation-patterns as heritable characteristics and in some of the types these characteristics may be more adaptable and plastic while in others they are comparatively rigid. This aspect affects the very basis of crop-production, but fortunately for us adaptability and compensation in cane, where present, help to mitigate the influence of proliferation-patterns. Then again, we have the problem of ripening. It is perhaps possible with our present knowledge to partly understand and explain the differences in the progress of ripening as observed in the different tracts, but the precise relationships between the individual controlling environmental factors, temperature, humidity and soil condition on the one hand and the physiological processes of photosynthesis, translocation, sugar synthesis and growth on the other are not known in a clear and disentangled form from their combined effects and reactions. This is a purely physiological aspect, but since the governing factors are largely beyond human control, the solution of the problem may very largely have to be attempted through a careful choice of the parent material.

Leake conceives of these studies on a world-wide scale, as they have to be if they are to have the advantage of the wide variation in environment under which sugarcane is grown. He stresses the need for the co-operation of research workers of many countries, and the standardisation of methods and measurements. In India the problem is of much importance. We have a sugar industry covering the tropical and the sub-tropical; we have cane cultivation under even more widely varying environmental conditions, in tracts which might well seek the application of useful results, even though they do not have a white sugar industry. While the problem is
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thus important, we also have certain advantages. We have a network of research stations where these studies can be carried out. A fairly wide range of genetic stocks of various cultivated and wild canes from within the sub-continent as also from parts of the adjoining countries is now available for study and use in breeding. It should be useful and possible to undertake co-ordinated studies on the responses of various types of cane to the various combinations of environmental factors. While the ultimate results of such studies would lead to well controlled breeding and further refinements in the selection technique, the most immediate results will help the individual tracts themselves to step up their agricultural improvements.

REFERENCES