VERNALIZATION

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THERE has appeared recently an account of work in Russia that is of considerable scientific interest and that may prove to be of great practical importance, if the Russian results can be substantiated and applied to agricultural practice. Briefly, the report announces the discovery of a method of pre-treatment of seed before sowing whereby the period subsequently taken by the plant to come to maturity is lessened without its yield being adversely affected. If it can be applied to agricultural practice it will have considerable results at least in the Temperate Zone, for it will mean that the advantages of early sowing will be attained under conditions where actual sowing in the field would be impossible owing to the presence of snow or to the low temperature, and will thus make possible, if not an extension of cultivation into higher latitudes, at least a more intensive cultivation in those regions where the present growing season is very short.

The Russians call the new process "Jarovizatzia", referred to in German publications as "Jarowisation", but in English the term is replaced by its Latinized equivalent "Vernalization". Its application is based on the distinction between the two phenomena of (1) the growth, or increase in weight and size of a plant, and (2) development, or the transition of the plant through successive phases, in its life history apart from mere vegetative growth. These phenomena are, or can be made to be, independent of one another.

"Under artificial conditions in a greenhouse it is possible arbitrarily to accelerate or retard reproduction by varying the conditions of light, darkness, temperature, humidity, etc. according to the specific requirements of each plant. Under ordinary field conditions this is not the case, and the vegetative period of a plant depends mainly upon the natural conditions of the regions in question. Hence in any particular area only those plants whose vegetative period is such that seed formation falls within the limits of the external factors characteristic for the region are suitable for cultivation. The essence of the method

of vernalization is the elimination of the effect of natural geographical and climatic factors limiting the introduction into field cultivation of any desirable plant".

It is emphasized by the Russian workers "that the transition to the reproductive stage is not only independent of the size and age of the plant, but is not correlated in time with growth. The plant may change qualitatively in a required direction without continuing to grow and *vice versa*, the plant may grow and yet not effect the required qualitative change. The processes of vernalization are independent of growth but connected with the environment; if the external condition be favourable both for growth and qualitative change in the plant, the plant will grow and pass through the stages preparatory to reproduction. *The fact that the process of preparation of a plant towards reproduction may occur in the embryo and may be separated in time from the growth of the plant makes possible the practical application of the method of vernalization*".

The principles of vernalization have been applied to plants associated with tropical and sub-tropical regions as well as to plants of temperate climates. Tropical and sub-tropical, or "short-day" plants as they are called, require a combination of high temperature and short daily period of light for reproduction. It is stated that short-day plants require light for the processes of growth and darkness for reproduction, and that the influences are exerted by light and darkness themselves and not necessarily by an alternation of the two. If therefore the plant can at some stage of its development be given a concentrated dose of the darkness factor, it will require no further period of darkness to enable it to pass through the reproductive phase. This is done by forcing the seed to grow and then artificially stopping its growth, after which it is subjected to the influence of the appropriate external factor. "Thus the sowing material, represented by the pre-treated seed, may have the appearance agronomically of seed, but from this new point of view it should be regarded as seedlings". In actual practice, the seed is made to germinate by soaking in water, and is then subjected to darkness for a certain time at a certain temperature. The amount of water used, the time kept in darkness and the temperature are all adjusted so that germination is strictly controlled, and that the actual growth is as little as possible. It is necessary to determine by experiment the details for each crop but preliminary experiments have been made with maize, sorghum, Sudan grass

and soya bean and it has been found that plants raised from pre-treated seed have flowered appreciably before control plants. The technique for rice has not been worked out.

There are striking points of similarity in the above process and the methods used by the Sinhalese paddy cultivator and it is interesting to speculate whether the goiya has unconsciously anticipated the Russian scientists. Before sowing his fields, the paddy cultivator soaks his seed in water for 12 to 24 hours, then wraps it up in gunny bags or plantain leaves and leaves it for six to eight days to germinate after which it is sown. The reason given for germination is that seedlings are more quickly and easily anchored in the mud of the field and are not so likely to be washed away or concentrated in lowlying parts of the field as would be seed; and the reason for putting under pressure is that germination is thereby hastened and the resulting seedlings are more evenly germinated. There is no deliberate attempt to exclude light from the heap, yet it is almost inevitable that light should be excluded, and there are thus created all the conditions that are said to be necessary for vernalization. Is it not then possible that the villager's seed is being vernalized and that seed of the same variety sown dry at the same time would take appreciably longer to come into ear ? Experiments are in hand to determine these points, and of them an account will be given in due course. It should be stated that the temperatures reached in a heap of paddy seed under pressure are much higher than any that have been hitherto determined for the vernalization of tropical crops, and that the amount of water used for soaking in the Russian experiments is much less than the amount the seed will absorb; nevertheless, the general methods are so similar that it would be surprising if similar results were not achieved.

On the other hand should further shortening of the vegetative period be possible by suitable treatment, it may be that a high yielding Maha strain of paddy may be made to mature, without loss of yield, in the space of a Yala season, or that a high yielding strain of whatever age may be introduced into a tract where it could not otherwise be grown on account of a slight difference in age. These questions remain to be investigated.

For information on the principles and methods of vernalization I am indebted to Bulletin No. 9 of the Imperial Bureau of Plant Genetics, from which I have quoted freely.