

ENVIRONMENT AND PLANT LIFE*

ONE of the outstanding developments in Agriculture during the past few years has been the study of plants in relation to their environment from new angles. The old definition of the word environment — “the conditions influencing development or growth” — apply precisely to these recent studies, and the results of the investigations have necessitated the coining of several new words. Perhaps the best-known of these are “photoperiodism” and “vernalization.” In order to appreciate what these words imply some explanation may be necessary.

Green plants owe their characteristic colour to the chlorophyll they contain. With the aid of this substance, the leaves and other green parts of plants, by utilising sunlight, are able to elaborate starch, sugar and other organic substances from the minute quantity of carbon dioxide contained in the air. It is hardly impossible to over-estimate the importance of this process, for without it all forms of life would cease to exist.

During the countless generations which have gone before, plants have definitely accustomed themselves to the light and climatic conditions under which they normally grow, and the length of day is one of the most important factors to which plants have to become accustomed. During night-time, the elaboration of carbohydrates continues, and under normal conditions there is a definite balance between the day and night functions of the plant which regulates not only the growth of the plant but also its reproductive function. Recent investigations have shown that the majority of plants fall readily into one or three groups:

- (a) long-day plants;
- (b) short-day plants, and
- (c) plants apparently indifferent to the length of day.

The word “photoperiodism” is, therefore, a term applied to the length of day requirements which are found to be normally necessary for the optimum growth conditions of a plant. The importance of this discovery is best illustrated by attempting to introduce a crop which normally grows under different conditions from those which prevail in the country in which it is proposed to grow it. We are all well acquainted with the statement that in regard to such crops it is necessary to import fresh seed every third or fourth season, otherwise the crop deteriorates. The results of recent experiments would indicate, however, that this is not the correct interpretation, but that an attempt should be made to secure a strain which is indifferent to, or has definitely adapted itself to the new conditions. It is obvious that this could not be anticipated in one or two seasons, but would probably require a number of years before it was sufficiently acclimatised to enable suitable strains to be selected.

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It has been found that in addition to the requirements of a definite length of day, climatic conditions also play a most important part, and it has been found possible, by applying artificial conditions during part of the life of a plant, to affect the ultimate growth in a most remarkable manner. The most important work in regard to this question was carried out at the Odessa Plant Breeding Station by Lyssenko in 1931, and it was from these experiments that the word "vernalization" arose. In this case the original experiments aimed at shortening the time necessary for the plant to pass through all the stages of its life-cycle to produce flowers and seed. It was found that if the necessary adjusting conditions were applied during the young seedling stage, while the plant is living on the food stored in the seed, the plants obtained from such seed could then be grown under the new conditions exactly as if the conditions applied to the germinating seed were being continued. The process of vernalization is therefore the pre-treatment of seed to expose it to the conditions necessary for transition to the reproductive stage.

In the case of tropical and sub-tropical plants, where short days are necessary for normal seed-production to take place, it was found that by subjecting germinating seed to suitable conditions of humidity, temperature, aeration and darkness, such seed would then produce plants which would flower and set fruit even when grown under conditions of continuous illumination. It should be realised, therefore, that the process of vernalization may have a most important bearing on the future production of crops, and that this process, coupled with suitably controlled growing conditions, may make it possible to grow any variety of plant under what would have appeared previously to be abnormal conditions.