some secondary product such as ATP. This essential protein may be some enzyme which controls cell wall loosening and which is destroyed in the course of its action. Or it may be some structural cell wall protein, such as that reported by Lamport[11], which must be incorporated into the wall in order that continued elongation may occur. The effect of hydroxyproline on protein synthesis and the existence and nature of the essential product of protein synthesis are now under investigation.

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## Relationship of Relative Leaf Growth Rate to Net Assimilation Rate and its Relevance to the Physiological Analysis of Plant Yield

IN the growing plant, where the photosynthetic tissues make the major contribution to dry-matter production, the absolute growth rate at any time is the product of the rate of increase in weight per unit of leaf (net assimilation rate[1], N.A.R.) and the amount of leaf present. The latter is usually expressed in terms of leaf area, which is the product of leaf weight and the area-to-weight ratio.

The relative rate of increase in leaf weight (relative leaf growth rate—R.$L_W$.G.R. expressed on a weight basis) may be increased either by an increase in N.A.R. or by an increase in the proportion of the products of assimilation which are devoted towards leaf growth. This does not seem to be widely appreciated, and the proportion of the products of assimilation going towards leaf growth is not generally calculated in growth analysis. This variable can be expressed as the ratio of R.$L_W$.G.R. to N.A.R. and is most simply calculated for a time-interval $t_1$-----$t_2$ as $(L_{t2}-L_{t1})/(W_{t2}-W_{t1})$, where $L$ refers to leaf weight and $W$ refers to total weight; it is hereafter referred to as the leaf-to-total growth ratio L.T.G.R.

If plant growth is considered as a compound interest phenomenon[2] and the leaf area to leaf weight ratio to be constant, plant weight at any time would depend on the initial productive capital (leaf weight), the rate of interest on this capital (N.A.R. calculated on a leaf weight basis), the proportion of interest re-invested in productive capital (L.T.G.R.) and the period of time involved.

Leaf area/leaf weight is not, however, constant, and since area is probably a more useful measure of the amount of photosynthetic tissue than is weight, plant growth over its entire period must be considered to depend on: (*a*) the initial leaf area; (*b*) N.A.R. calculated on the basis of leaf area; (*c*) L.T.G.R.; (*d*) relationship of leaf area to leaf weight; (*e*) the length of the growing period.

It is clear, therefore, that the yield of crop plants can depend in large measure on the way in which the products of assimilation are allocated, that is, on the L.T.G.R. Thus the supply of nitrogenous fertilizer to cotton plants increases the relative leaf growth rate but not the net assimilation rate[3]; therefore, as Heath[4] pointed out, it increases the proportion of assimilate going to leaf, raising the ratio of leaf weight to total weight and consequently the relative growth rate. This treatment results in a large increase in leaf weight, in total weight, and in economic yield (seed cotton). It is, however, under conditions where the net assimilation rate and the relative leaf growth rate are varying in the same direction that it is of most value to calculate the L.T.G.R. in order to determine how much of the change in relative leaf growth rate and therefore in ultimate leafiness is in fact solely due to change in N.A.R.

The concept of L.T.G.R. is being used in a detailed investigation of the physiological basis of treatment effects on and seasonal variation in the yield of cotton which will be reported in detail elsewhere. This variable has also been calculated by Rees[5] working with oil palm.

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## Stomatal Distribution in Relation to Xeromorphy in Aquatic Plants

IT is well known that xeromorphy is of physiological importance[1] to the aquatic plants which exhibit it and certain tissues become altered in relation to environment. The modifications in internal leaf structure include a higher stomatal frequency. Limited enlargements of epidermal cells result in the increase in number of stomata per unit area. Though these are the features of a xerophyte, experimental evidences to show the stomatal distribution in relation to xeromorphy exhibited by an aquatic plant are meagre. In an attempt to elucidate the problem of xeromorphy in aquatic plants the wild species of *Ipomoea carnea* Jacq growing in different ecological habitats, that is, aquatic and xerophytic, was selected. The aquatic plants were selected from those growing at a 3–5 ft. depth of fresh-water in ponds and ditches and the xerophytic plants from those growing in the sandy soils of the plains. Though these plants belong to the same species they are not alike but have become adapted through generations of growth in the particular habitat. We consider that a comparison between the same species which has grown naturally under different ecological habitats might better contribute towards our understanding of the nature of xeromorphy than inducing xeromorphy under artificial conditions. The species considered here is a straggling shrub with milky juice and ovate-cordate leaves with large convolvulaceous pink flowers. The plant grows abundantly both in dry and marshy places besides its aquatic habit in various parts of India.

The healthy branches were selected from the plants growing under different habitats, leaves serially numbered from top to bottom and the stomatal counts were made after the nitric acid method as already described[2]. The area of the leaf was measured with a planimeter. Absolute stomatal number was determined by multiplying the average number of stomata per square mm of leaf area with the square mm area of the leaf. The results are expressed as percentages of that of the aquatic plant in Table 1 with respect to the absolute stomatal number and stomatal distribution per unit area.

The results indicate that when xeromorphy is exhibited by an aquatic plant, the absolute stomatal number increases 3–5-fold. There is a decrease in the ratio of absolute stomatal number between the upper to the lower surface of the leaf, as the leaf matures. A gradual shifting