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INFLUENCE OF CONTINUOUS LIGHT ON THE TOMATO

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As aearly, as 1929, Guthrie (2) observed that under continuous light tomato leaves become chlorotic. Later, this „leaf injury" — as the research workers name it — is studied especially in connection with continuous light and invariable temperature.

ARTHUR, GUTHRIE and NEWELL (1930), RODENBURG (1937), WITHROW (1949), HIGHKIN and HANSON (1954), LAURENCE and CALVERT (1954), all quoted by 2), showed that low temperatures reduce the negative effect of continuous light on the tomato.

The same chlorotic aspect of leaves, in conditions mentioned above, is observed by KRISTOFFERSEN in his detailed studies relating this problem (2).

Kettellapper's experiments have shown that in continuous light, in long photoperiods and in cycles of 48 and 72 hours with a shorter photoperiod than optimum, the chlorotic leaves appear always.

All the authors above, reported the „leaf injury" appearing under continuous light when temperature was invariable. In these conditions, the plants have yellow leaves with necrotic spots, that finnaly dried.

In our experiments relating to influence of photoperiod on the tomato, we found at the plants in continuous light a „degeneration" of whole plant, although in conditions in which the night temperature was different from the day's one.

Materials and methods. Plants were grown in pots, in artificial light provided by fluorescent tubes, in conditions established as optimum by the other authors (2, 3, 4, 5, 6). Day temperature was 23—25°C and night temperature 15—17°C. Light intensity at the level of plants was 6000 lux. The tested variety was Moneymaker.

Total leaf area measured by planimetric method, chlorophyl quantity by a colorimetric method (with Dubosq colorimetre), transpiration intensity with torsion balance (Ivanov's method) and photosynthesis and respiration were determined using the Warburg apparatus. The photosynthesis intensity was exprimed in O_2 released in the respiration in ml O_2 cosumated.

Results and disscussion. Plants in continuous light showed, at first, an intensive violaceus colour of stems and leaves, later this colour disappears from the leaves and became yellow with necrotic spots. In a more advanced stage, plants showed a considerabily high lignification (12,55% S.U. comparative to 8,09% to the 15 hours photoperiod, although

photosynthesis intensity was lower). Leaves remained smaller and the whole aspect was that of a diseased plant, althought we can't establish some pathologycal cause. At the same time, the plants grown in 15 hours/day were vigorous, with normal flowers and fruits.

Different vegetative and physiological aspects are presented in table 1. We have studied these aspects comparatively in two light conditions; continuous light and 15 hours light/day, photoperiod established as optimum in an other experiment.

Table 1

Morphological and physiological aspects of „degenerated" and normal plants

Var.	Leaf area cm^2/plant	Dry matter percentage in leaves	Chlorophyl quantity mg/g S.U.	Photosynthesis intensity ml O /dm^2/h	Respiration intensity ml O /dm^2/h	Transpiration intensity mg $H_2O/cm^2/h$
Continuous light	103,95	19,67	10,63	3,83	9,4	8,33
15 hours light/day	241,25	14,76	23,36	11,00	16,2	7,23

Note: S.U. = dry matter.

Dry matter percentage is more in leaves of plants under continuous light — 19,67% compared to 14,76% at 15 hours light/day. This is not a result of a more intensive photosynthesis that represents only 1/3 from photosynthesis of plants grown in 15 hours light/day, but is a result of plant lignification.

In continuous light at a constant temperature, Kristoffersen's results are different. Otherwise, he reported only to leaf injury and no to lignification that we have observed. Early studies (2) emphasized a photosynthesis intensity „surprising high" at chlorotic leaves, intensity wich later decrease. In conditions in wich temperature is different between day to night, in our experiment, photosynthesis intensity of „degenerated" plants represents only 1/3 from photosynthesis of those grown under 15 hours light/day.

In acordance with our results, we explain the differences in photosynthesis intensity between the two variants by a much lower chlorophyl quantity, by water balance deficit in leaves resulting from a transpiration more intensive in degenerated plants in relation to the normal plants.

In addition to a weaker assimilation, the transpiration was more intensive in degenerated plants, and the consume by respiration was much higher. Comparative dates on ratio between assimilated substances at the two variants and consumation by respiration, the later is much higher in degenerated plants. Respiration intensity of the later (table 1) represents 2/3 from that of normal while the photosynthesis intensity ratio between the two is only 1/3.

This high consume of nutritive substances and the more intensive transpiration, cause a much weaker vegetative growth of degenerated plants, an aspect noted in our experiment and also in other studies (2, 5, 6). Leaf area of these plants represents less than 50% from leaf area of plants that received 15 hours light/day.

The authors consulted (2, 6) consider that 80—90% of growth is getting on, in natural conditions, during dark period.

The assumption that growth take place especially during the night period (2) is confirmed by our results, but these later shows also other causes of degeneration than those mentioned above.

We suppose there are also another interesting problems to study, especially in connection with the existence of photophyll and skotophyll phases supported by some authors, as Went and Bunning (2, 3) as well as the necessity of dark period to restore leaves turgor pressure and to synchronize endogenous rythm in plant, light influence on translocation, as well as other aspects.

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