THE INFLUENCE OF DIFFERENT TEMPERATURES AND LIGHT INTERSITES ON GAS EXANGE OF AVOCADO LEAVES (*PERSEA AMERICANA* MILL.)

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by

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1. Gas exchange of attached avocado leaves (CV Fuerte) was measured under controlled conditions. An open gas exchange system for simultaneous measurements of CO_2 and H_2O exchange was used

2. Net photosynthesis, transpiration, stomatal and mesophyll resistance, CO_2 compensation point, VPD, VPG and the photosynthesis/transpiration ratio were measured and calculated under various temperatures between 10°C and 40°C.

3. The same parameters were measured also under nine different light intensities between 45-1350 μEM^{-2} Sec^{-1} and four temperatures 22ºC, 27ºC, 32°C, 37°C.

4. Gas exchange was measured separately at the tip and the base of the leaves.

5. The optimal temperature for net photosynthesis was found between 20ºC and 30°C. Net photosynthesis declined at higher and lower temperatures due to an increase in stomatal and mesophyll resistance,

6. A negative curvilinear relationship was found between net photosynthesis and stomatal resistance as well as with mesophyll resistance, Mesophyll resistance was linearly correlated with stomatal resistance and CO_2 compensation point.

7. Maximal transpiration was obtained at 35ºC namely 5ºC higher then for photosynthesis. Transpiration was mainly controlled by VPG.

8. Photosynthesis and transpiration declined above 35ºC due to an increase in stomatal resistance.

9. The ratio of photosynthesis to transpiration decreased exponential) with increasing leaf temperature and VPG due to a parallel increase in stomatal and mesophyll resistance.

10. The VPG was positively related (curvilinear relationship) with leaf and air temperature and therefore affected similarly transpiration, net photosynthesis and stomatal resistance.

11. Stomatal and mesophyll resistance were minimal between 20°C and 30°C. Mesophyll resistance increased more then stomatal resistance and CO_2 compensation point above and below those temperatures.

12. In an experiment where net photosynthesis was similar at 10°C and 40°C it was found that the mesophyll resistance, stomatal resistance and CO_2 compensation point were 3.5; 1.5; and 2 times respectively higher at 40°C as compared to 10°C.

13. When leaves were subjected to different temperatures it was found that net photosynthesis and stomatal resistance were affected by the initial temperature. All measurements made after subjecting the leaves to 10°C showed lower average net photosynthetic rates.

14. Net photosynthesis Increased with increasing light intensities at all four temperatures used in the experiments. Light saturation was achieved at 22% of full sunlight between 20°C and 32°C while at 37°C saturation was lower (12.5% of full sunlight).

15. The differences in light saturation for transpiration at different temperatures were due to the changes in VPG. Saturation at high temperatures was achieved due to stomatal closure. Transpiration rates at 20°C and 27°C were smaller then at 32°C and 37°C.

16. Net photosynthesis and transpiration rates were lower at the top of the leaves than at the base. The difference was not only in higher stomatal resistance but also due to internal factors.

17. The coefficient of variation of all the measurements was high in avocado leaves compared to other species. The variation increased at high temperatures.

18. The optimal temperatures for net photosynthesis, the low

net photosynthetic rates, light saturation curves, CO_2 compensation point and mesophyll resistance of avocado leaves were found to be typical for C_3 plant.

19. Maximum net photosynthesis measured under optimal conditions was 9.64 mg CO_2 dm^{-2} h^{-1}. This value is nearly consistent with the values found in the literature. The average net photosynthesis for all the measurements made under optimal conditions was 5.34 ± 1.63 mg. CO_2 dm^{-2} h^{-1}. These values are low even for C_3 plants and may influence the potential productivity of the avocado tree.

20. An analysis of the climatic conditions and light intensities in the northern part of the Jordan Valley suggests that high temperatures during the summer are likely to be the major limiting factor of net photosynthesis in this area.