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Photosynthetic Light Intensity Responsive Curve of Mango cv. Alphonso under Man-Made Light Source

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A B S T R A C T

The research project entitled "Study of Photosynthetic Light Intensity Responsive Curve of Mango Cv. Alphonso under Man-Made Light Source. All physiological process required optimum light conditions. The amount of photosynthesis efficiency depends upon the light intensity levels. Treatment details were 100 pfd, 250 pfd, 500 pfd, 750 pfd, 1000 pfd, 1250 pfd, 1500 pfd, 1750 pfd and 2000 pfd with four replications were made. The obtained results were the saturation point in the photosynthetic light intensity responsive curve of mango Cv. Alphonso was in between 750 - 1000 pfd. The maximum rate of physiological activities were higher in this saturation point (i.e. photosynthesis, transpiration and stomatal conductance rate).

Introduction

Mango (*Mangifera indica*) is the leading fruit crop of India and considered to be the king of fruits. Besides delicious taste, excellent flavour and attractive fragrance, it is rich in vitamin A and C. India is the largest producer of mango in the world, and ranks first in area and production. The total production of mango in India is 16.20 million MT from about 2.38 million ha area with the productivity of 6.8 MT/ha, which is 35.47 per cent of total area and 21.19 per cent of the total production under fruit crops in the country. From June to September, the Konkan area receives 3000 to 4000 mm of rain. Cloudy days during this time diminish the number of sunshine hours available to the mango crop, lowering the rate of photosynthesis available to the crop and contributing to low yield. In recent years, the Konkan region has experienced significant climate anomalies during all three seasons, namely monsoon, winter, and summer; such as anomalous rains, rapid temperature swings, fog, gloomy days, and so on, which have harmed mango tree growth and caused morpho physiological alterations.

Light is the essential component of photosynthesis process. The formation of photosynthates is the

basis of plant growth and production. Net photosynthesis is influenced by environmental factors viz; light, temperature, CO_2 concentration, water, fertility of the soil, etc. as well as by plant related factors. In fruit trees, fruit yield and quality depend on the light interception within the plant canopy. Photosynthesis rate, Transpiration rate and stomatal conductance are influence by different light intensities. Higher and lower light intensity causes lower physiological rate.

Materials and Methods

The experiment was conducted in Nursery, Department of Horticulture, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) India. The experimental material for the study consist of nine treatments with four replications, treatment details shown in Table 1. Mango Cv. Alphonso healthy grafts with equally height and other all morphological parameters are selected. Fertilizers and farm yard manure were blended into the soil before being applied. Physiological observations was taken with help of light florescence attached portable photosynthesis system (LICOR 6400xt, Loc. Inc. USA) model. The whole experiment conducted at 9:00 A.M to 12:00 day time period.

Results and Discussion

Rate of Transpiration

Increases in light intensity increased the rate of transpiration, but only until light saturation was reached, after which it was reduced. At higher and lower light intensities, it was less, and at light saturation point, it was the highest.

Data regarding rate of transpiration are presented in Table 2 and Fig.1. Significant differences in respect of rate of transpiration were obtained at all levels of photon flux density (PFD). Rate of transpiration of all treatments recorded were taken at three minutes interval period. Mean of transpiration rate was 0.172. The rate of transpiration was maximum in treatment T9 (0.214) (i.e. 2000 PFD), followed by T8 (0.210) (i.e. 1750 PFD) which were at par with each other. The lowest transpiration rate was found in T1 (0.122) (i.e. 100 PFD) and T2 (0.136) (i.e. 250 PFD), which were at par with each other.

Changes in light intensities have an impact on the rate of transpiration. At greater and lesser light intensities, physiological activity slowed or ceased, and stomatal conductance was reduced, resulting in a low rate of photosynthesis at lower and higher light intensities, with similar outcomes in rate of transpiration.

Rate of Stomatal conductance

Data regarding rate of stomatal conductance are presented in Table 3, and Fig.2. The stomatal conductance rate was lowest at lower light intensities, gradually increased, peaked at light saturation, and subsequently dropped as light intensities increased.

Significant differences in respect of rate of Stomatal conductance were obtained at all levels of photon flux density (PFD). It was found that variation among different treatments. Mean rate of stomatal conductance was 0.1009. The rate of stomatal conductance was maximum in treatment T4 (0.1114) (i.e. 750 PFD), followed by T5 (0.1109) (i.e. 1000 PFD) T6 (0.1052) (i.e. 1250 PFD) and T8 (0.1022) (i.e. 1750 PFD) which were at par with each other.

The lowest stomatal conductance was found in T1 (0.0903) (i.e. 100 PFD) followed by T2 (0.0938) (i.e. 250 PFD) and T9 (0.0.956) (i.e. 2000 PFD) which were at par with each other.

At both low and high light intensities, the rate of photosynthesis was lower. At severe light intensities, stomata (which open and close) were shown to be less functional.

Table.1 Treatments details are given below

Treatment details	
T1	100 pfd
T2	250 pfd
T3	500 pfd
T4	750 pfd
T5	1000 pfd
T6	1250 pdf
T7	1500 pfd
T8	1750 pfd
T9	2000 pfd

* pfd (Photon flux density)

Table.2

Treatments	Rate of transpiration (mol H_2Om^{-2} Sec^{-1})
T1-100 pfd	0.122
T2-250 pfd	0.129
T3-500 pfd	0.146
T4-750 pfd	0.160
T5-1000 pfd	0.180
T6-1250 pfd	0.190
T7-1500 pfd	0.192
T8-1750 pfd	0.210
T9-2000 pfd	0.214
Mean	0.172
S.Em±	0.005
C.D. at 5%	0.015

Table.3 Photosynthetic Light Intensity Responsive Curve of Mango Cv. Alphonso of Rate of Stomatal conductance.

Treatments	Rate of Stomatal conductance (μ mol H_2Om^{-2} Sec^{-1})
T1-100 pfd	0.0903
T2-250 pfd	0.0938
T3-500 pfd	0.0976
T4-750 pfd	0.1114
T5-1000 pfd	0.1109
T6-1250 pfd	0.1052
T7-1500 pfd	0.1011
T8-1750 pfd	0.1022
T9-2000 pfd	0.0956
Mean	0.1009
S.Em±	0.0052
C.D. at 5%	0.0153

Table.4 Photosynthetic Light Intensity Responsive Curve of Mango Cv. Alphonso of Rate of Stomatal conductance.

Treatments	Rate of Photosynthesis (μ mol H_2Om^{-2} Sec^{-1})
T1-100 pfd	2.1816
T2-250 pfd	5.4238
T3-500 pfd	7.4157
T4-750 pfd	8.4856
T5-1000 pfd	8.3292
T6-1250 pfd	8.0839
T7-1500 pfd	8.1720
T8-1750 pfd	8.0253
T9-2000 pfd	7.7128
Mean	7.0922
S.Em±	0.3066
C.D. at 5%	0.8949

Fig.1 Rate of Stomatal conductance

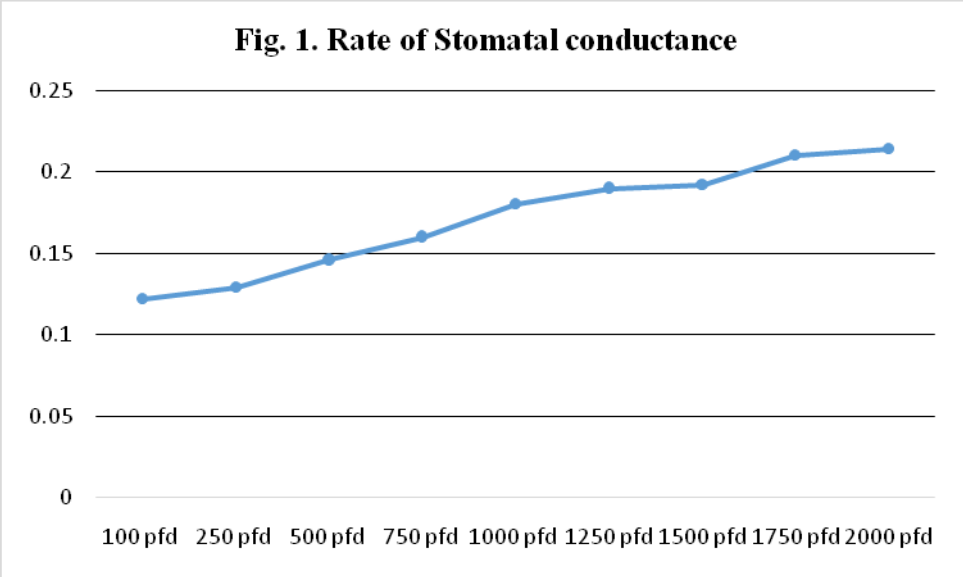


Fig.2 Rate of Stomatal conductance

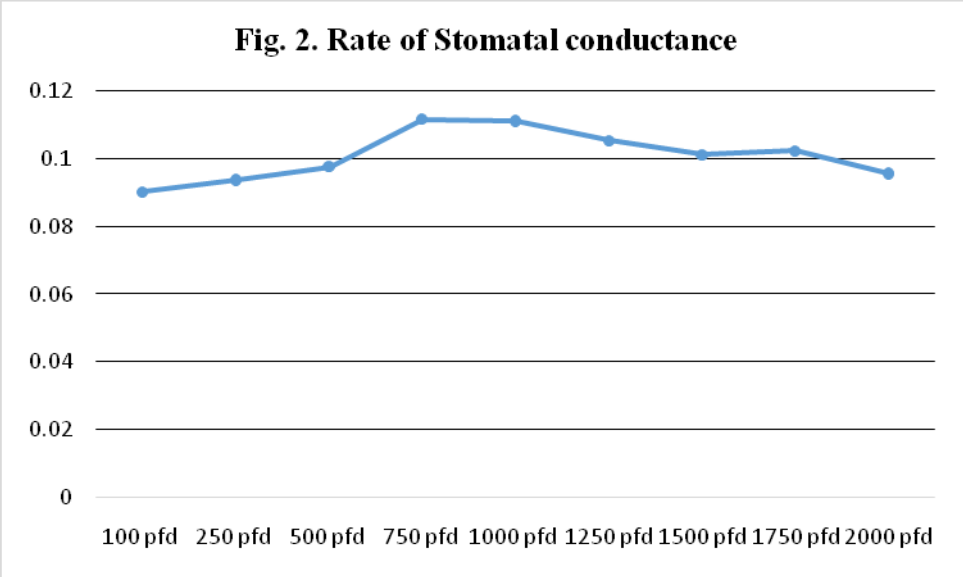
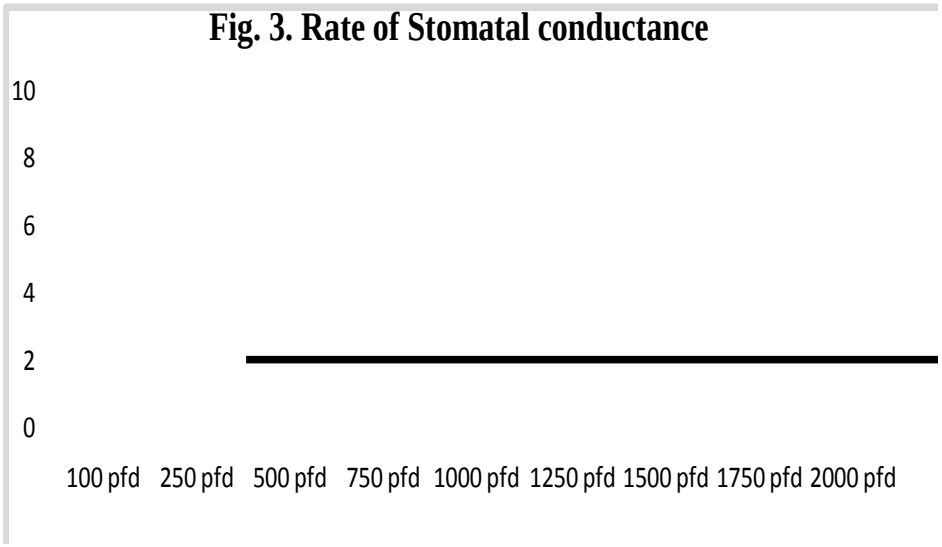


Fig.3 Rate of Stomatal conductance



The highest rate of photosynthesis occurred near the light saturation point, which resulted in the highest stomatal conductance rate. Similar results were obtained by Wang Tian *et al.,* (2008) in *Cucumis sativus* and Juntamanee *et al.,* (2013) in mango.

Rate of Photosynthesis

Data regarding rate of photosynthesis are presented in Table 4 and Fig.3. Significant differences in respect of rate of photosynthesis were obtained at all levels of photon flux density. Rate of photosynthesis of all treatments recorded were taken at three minutes interval period. There was significant variation among different treatments for rate of photosynthesis occurred in response to given light intensity. Mean rate of photosynthesis was 7.0922.The rate of photosynthesis was highest in treatment T4 (8.4856) (i.e. 750 PFD), followed by T5 (i.e. 1000 PFD) which were at par with each other. The overall lowest rate of photosynthesis was recorded in T1 (2.1816) (i.e. 100 PFD). At the light saturation point, the rate of photosynthesis was maximum. The physicochemical processes in plants are hampered under both situations, i.e. light intensity below and above the light saturation limit, which affects the rate of photosynthesis in plants. Similar results recorded in present investigation are in agreement with the finding of Wang Tian *et al.,* (2008) in *Cucumis sativus* and Juntamanee *et al.,* (2013) in mango. In the present investigation the light saturation point (i.e. intensity of light at which rate of photosynthesis reaches at peak and then remain almost stagnate) was observed to be in between 750 PFD to 1000 PFD in mango Cv. Alphonso. Whereas the available light intensity during cloudy non sunny days is also 100 to 250 PFD i.e. about 4-5 times less than the minimum light intensity required for the normal photosynthesis. Similar results recorded in present investigation are in agreement with the finding of Kulkarni *et al.,* (2015) in Mango, Peri *et al.,* (2009), Wang Tian *et al.,* (2008) in *Cucumis sativus* and Juntamanee *et al.,* (2013) in mango.

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References

Juntamanee. K, onmon. S, Yingjajaval. S and S. Sangchote (2013) Leaf photosynthesis and fruit quality of mango growing under field

and plastic roof condition. 4th international symposium on tropical and subtropical fruits. *ISHS. Acta Hort*. 975.

Kulkarni M. M., Burondkar M. M, Haldankar P. M., K. Mallikarjuna and K. D. Kelkar (2015) Screening of mango (*Mangifera indica* L.) varieties for photosynthetic light response curve grown in Konkan region of India. *3rd International plant physiology congress*, New Delhi., Souvenir: 320.

Peri P. L., Martinez P. G., Lencinas M. V. (2009) Photosynthetic response to different light intensities and water status of two main Nothofagus species of southern Patagonian forest, Argentina. *Journal of forest science*. 55(3): 101–111.

Wang Tian, Suping Wang, Shirong Guo, and Yanjun Sun (2008) Effect of exogenous spermidine on the photosynthesis of *Cucumis sativus* L. seedlings under rhizosphere hypoxia stress. *Agric, China*. 2(1): 55-60.

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