Evaluation of vegetative development of peanut (*Arachis hypogea* L.) crop under different solar radiation incidence

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ABSTRACT

The availability of solar radiation in terms of amount and quality inside the canopy can affect crop physiologic processes, because the increase in peanut yield is directly related with increase of the chlorophyll concentration in leaves. Therefore, based in effect of climatic elements on the crop vegetative development, was aimed to evaluate the effect of radiant flow density in peanut crop, determining the parameter chlorophyll, under different plastic coverings (thickness of 75.10^{-6} and 150.10^{-6} meters) and with no shelter. The research was carried out using twelve lysimeters with three plant rows. In each row two soil solution extractors were installed, differentiated by depths from 0.15 and 0.25 m. The values of radiant flow density were obtained by luminosity meter. The collected data were obtained daily in each environment, observing inside and outside of experimental environments. It was also obtained total chlorophyll data. Three measurements were accomplished in the last three weeks of the vegetative crop cycle, at the 85, 94 and 101 Days After Sowing (DAS), which were obtained two measurements by plant line, being one for each depth, therefore, six measurements by each lysimeter. It was concluded that peanut harvest can be accomplished with success in extreme period of the vegetative crop cycle, of 120 to 130 DAS. It was also verified a larger solar incidence in environment without plastic covering, providing an efficient development of the peanut crop outside the protected environment. In all evaluations, smallest chlorophyll index occurred in environment with larger plastic film thickness, promoting reduction in photosynthesis process. The factor extractor's depth did not present significant differences, considering the environment with no shelter as others one with plastic covering.

Keywords: radiation flow, chlorophyll, experimental environments, Brazil

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1. INTRODUCTION

Concerns about solar radiation makes many manufacturing enterprises of plastic films participate the commercial market, with your different models in terms of thickness, size, etc. Several addictives were used in the plastic films manufacturing, presenting protection against the action of ultraviolet waves and controllers of light and radiation, as well, with influence in photosynthesis process, allowing the temperature fitting (Factor et al., 2000). Interactions between solar radiation with plants provide condition to internal microclimate of vegetable canopy. The availability of solar radiation in terms of amount and quality inside the canopy can affect crop physiologic processes (Assunção et al., 2008). The increase in peanut yield is directly related with increase of the chlorophyll concentration in leaves due to the largest absorption of nitrogen (Caires and Rosolem, 1999), with reduction of toxicant effect of the manganese on the process of N_2 symbiotic fixation, through elevation of the relationship Ca/Mn in the leaves (Rosolem and Caires, 1998). Therefore, based in the effect of climatic elements on the crop vegetative development, the goal was to evaluate the effect of radiant flow density in peanut crop, determining the parameter chlorophyll, under different plastic coverings (thickness of 75.10^{-6} and 150.10^{-6} meters) and no shelter.

2. MATERIALS AND METHODS

The experiment was carried out at "Luiz de Queiroz" College of Agriculture - ESALQ/USP, located in the geographical coordinates: 22º42'30 " S, 47º38'00 " W and elevation of 546 meters. Were used twelve lysimeters, which present dimensions of 1.60m length, 1.15m width and 0.7m height. The spacing used was of 3.5m between rows and 0.7m between lysimeters. Plastic films of different thickness were installed over the lysimeters, being considered three environments: no shelter, plastics covering with thickness of 75.10^{-6} and 150.10^{-6} meters (Figure 1a).
In each lysimeter three plant rows of peanut crop were sowed. In each row two extractors were installed, differentiated by depths of 0.15 and 0.25 m, being spaced of 0.575 m.
For determination of the radiant flow density, a luminosity meter was used, which supplies data in lux or lumen m^{-2}. The data collected by this device were obtained daily in each environment, always in the same schedule of collection, being observed inside and out of the facilities.
Considering the crop vegetative development, were certain total chlorophyll data, through of the clorofiLOG (Figure 1b), being data expressed in chlorophyll index (CI). For evaluation of CI, must be considered chlorophyll's levels of types A and B, possible for the results combination of mensurations in different wave lengths, determining total chlorophyll data. Three mensurations were accomplished during cycle of 105 days after sowing (DAS), occurred between May and August 2008. The mensurations were accomplished in the last three weeks of the vegetative crop cycle, at the 85, 94 and 101 Days After Sowing (DAS), which were obtained two measurements by plant row, being one for each depth, therefore, six measurements by each lysimeter.

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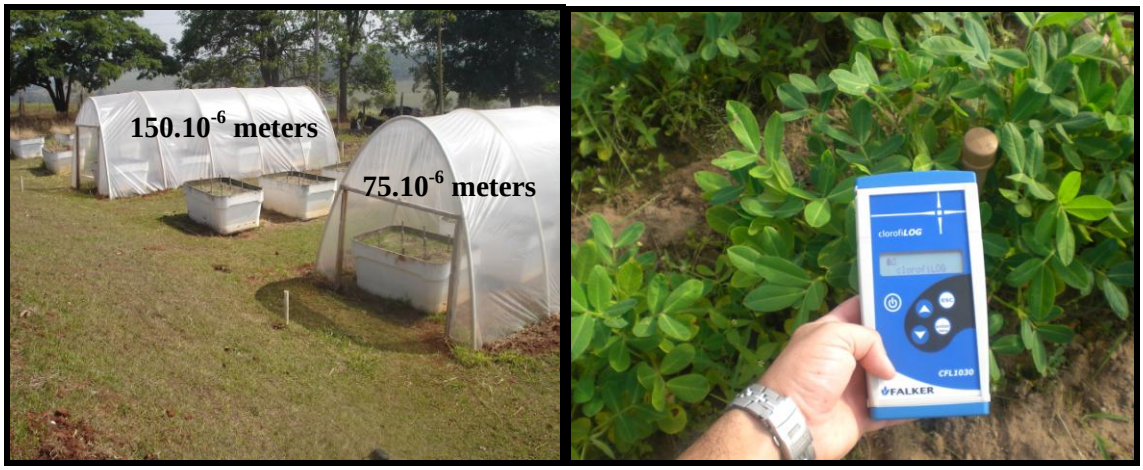

(a) (b)

Figure 1. Three environments and chlorophyll meter

3. RESULTS AND DISCUSSION

The evaluated lysimeter were denominated 1 to 4 (plastic covering of 75.10^{-6} meters), 5 to 8 (no shelter) and 9 to 12 (plastic covering of 150.10^{-6} meters). Considering only three evaluations to obtain total chlorophyll, was verified the largest peanut crop cycle (Figure 2) as larger will be chlorophyll index (CI), exemplifying, in interval of first to third evaluation, or, in 16 days, occurred a pigmentation on the average of 12 to 14 CI, verifying that peanut's harvest can be accomplished with success in extreme period of the vegetative cycle, of 120 to 130 DAS, as many farmers have doubt in not proceeding. This fact confirms the study of Caires and Rosolem (1999) verifying a larger peanut yield in function of largest chlorophyll presence in leaves. It should also be stood out, that this tendency to the largest chlorophyll presence had happened in three experimental environments. Analyzing vegetative development comparatively in three environments, was observed, in environment without plastic covering (lisymeters 5 to 8), in three evaluations, a larger chlorophyll index was verified in the leaves in relation to the other two environments, showed by the Table 1, demonstrating a larger radiant flow density in environment to no shelter, as it is in boldface. This fact was observed, even with presence of clouds, what is verified by decrease radiant flow density along three evaluations, the tendency stayed, larger solar incidence in environment without plastic covering, being, therefore, an indicative for a good development of the peanut out of a greenhouse. It is important to say the effect of the plastic material attenuation in vegetative development of this crop, because, in all evaluations, smallest chlorophyll index was presented in environment with larger thickness of plastic film (lisymeters 9 to 12), proven that a larger plastic film attenuation promove a reduction in process of the photosynthesis, being a counterpoint to many authors as Factor et al. (2000), that defends use of plastic film as a determinant in the photosynthesis efficient process. The factor extractor's depth did not present significant differences, mainly considering no shelter environment in the first evaluations and environments with plastic covering in the last evaluation.

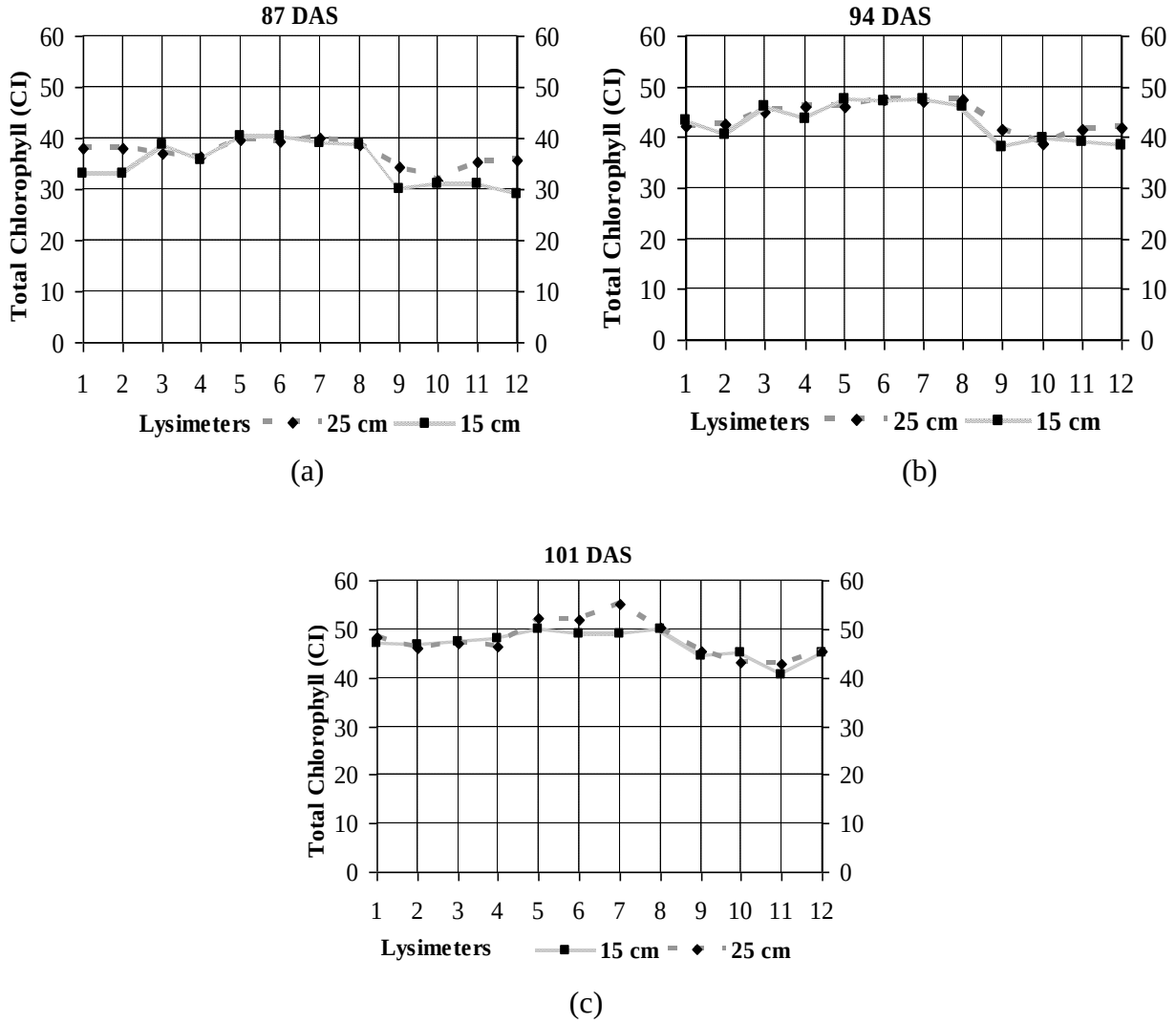

Figure 2. Total chlorophyll evaluated in final stage of peanut crop cycle

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Table 1. Radiant flow density (q1), along of the DAS, by attenuations conditions of 75.10^{-6} and 150.10^{-6} meters and no shelter

	Plastic covering (75.10^{-6} meters)	No shelter	Plastic covering (150.10^{-6} meters)
DAS	q_1 (W m^{-2})	q_1 (W m^{-2})	q_1 (W m^{-2})
31	906	963	753
38	634	785	548
45	142	186	128
52	204	312	172
59	490	554	454
66	185	199	180
73	763	926	555
80	833	891	743
87	465	**574**	430
94	183	**215**	182
101	43	**48**	34
108	232	289	225
115	639	753	590

4. CONCLUSIONS

The conclusions allow to say peanut's harvest can be accomplished with success in extreme period of the vegetative crop cycle, from 120 to 130 DAS. It was also verified a larger solar incidence in no shelter environment (without plastic covering), providing an efficient development of the peanut crop outside the protected environment facilities. In all evaluations, smallest chlorophyll index occurred in environment with larger plastic film thickness, which promoves a reduction in photosynthesis process. The factor extractor's depth did not present significant differences, considering a lot the environment with no shelter as others one with plastic covering.

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