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Simulation of Shading in Intercrops: Construction of light reducing cages.

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ABSTRACT
The shading of the shorter crop by the taller one in an intercropping situation could be simulated by the construction of cages covered by varying layers of mesh net. Comprehensive light measurements were taken to calibrate the cages and made them suitable for the shading experiments for which they were used. Details of the construction of the cages that could be used for such simulation of shading in intercrops, were reported. The comprehensive light measurements taken were also discussed.

Key words: Wooden cages, mesh net, light intensity, light measurements, intercrops, shading.

INTRODUCTION

It has been shown that the reduced light intensities due to overcast skies, prevalent in the southern part of Nigeria usually reduce crop productivity (Ezedinma, 1973). Despite this however, farmers in this area practice intercropping whereby two or more crops are grown on the field simultaneously. Such intercrop by the taller one in these situations has been shown to have adverse effects on the yield of the shorter crop (Prasad and Brook, 2005; Adeniran and Ayoola, 2007) thus further aggravating the light reduction caused by environmental conditions. Okeleye and Ariyo (2000); Ennin *et al.* (2001); Dapaah *et al.* (2003), all reported a decrease in yield of cowpea planted together with maize, where the maize shaded the cowpea, compared to sole cowpea crop. Granted that the decreased yield associated with the shorter crop could be due to other factors such as competition for nutrients, water and other resources, the shading by the taller intercrop definitely could contribute to the lower yield recorded. Shading of soybean in such a situation led to reduced yield of soybean of up to 60% in Indonesia (Surmano, 1987).

In experiments carried out by the author and collaborators, the adverse effects of reduced light intensities on soybean growth and development (Odeleye *et al.*., 2001), and on its source-sink relationships (Odeleye *et al.*., 2003 and 2004) in southwest Nigeria have been documented. In these experiments, cages were constructed to attain varying levels of light reduction which were subsequently imposed on soybean plants. The knowledge of how to construct the cages to use for such experiments and their calibration will be useful for researchers who may want to carry out similar shading studies.

The aim of the present paper is to report in details, how light reducing cages were constructed and the various light measurements taken to make the cages suitable for the conduct of the shading experiments.

MATERIALS AND METHODS

The constructed cages were made of obeche wood of 5cm x 5cm in thickness. The internal dimensions of each cage were 1.8 x 1.2 x 1.3m. The wooden frames were covered on all sides (except the bottom) with single or double layers of synthetic, green, 1mm mesh net to achieve varying levels of light reduction. The cages were braced on all sides except the bottom. The net used were obtained from the local market which makes it readily available to prospective users and experimenters. Light intensities within and outside the screens were measured using a light meter model 4555 type C (Megatron, England).

Light measurements were taken on sunny and cloudy days to take care of the differences of the

photon flux on the different days. Similarly, measurements were done on the roof top garden of the Department of Crop Protection and Environmental Biology (a four-storey building, about 15m high) as well as on the field. For each day, measurements were taken in the morning (0800 hr), afternoon (1300 hr) and in the evening (1700 hr). Because of the high variation/fluctuations in light intensities over very brief periods, each value was actually a mean of 5 measurements.

Results and Discussion

The detailed values of the various light measurements made are presented in Table 1. From the table, it is obvious that light intensities were inevitably generally highest in the afternoon, followed by morning and lowest in the evening. Similarly, photon flux were higher on sunny days than on cloudy days as expected. Furthermore, the values of light measurements were generally higher on the roof top than on the field indicating the higher photon flux characteristics of an elevated position such as the roof top of the Departmental building.

The grant mean of light measurements indicates that the cages covered by single layer of mesh net reduced light by approximately 25% while the cages covered by double layers of mesh net reduced light by about 50%, both on the roof top as well as on the field, when the mean values of measurements from the cages were expressed as percentages of values outside the screens, regarded as 100% light intensity.

The construction of these cages was therefore a veritable method of imposing reduced light intensities on experimental crops to simulate what obtains on the field in an intercrop, where we have reduction in the intensity of light reaching the shorter crop. Overall, the construction of these cages and the light measurements taken will be a useful tool in experiments involving shading, more so since further light reductions could be obtained by increasing the layers of mesh net as necessary.

Table 1: *Mean values of light measurements (in Lux) taken within and outside the cages constructed to simulate shading in intercrops.

Roof Top Garden							
Treatment	Sunny Day			Cloudy Day			Grand Mean
	Morning	Afternoon	Evening	Morning	Afternoon	Evening	
Outside	1420.836	1765.281	688.980	710.418	839.585	344.445	961.576 (100%)
One layer of mesh net	1065.627	1356.253	457.662	543.577	640.453	247.569	718.524 (74.70%)**
Two layers of mesh net	633.092	884.696	344.446	409.028	484.376	150.695	484.388 (50.37%)

Field							
	Sunny Day			Cloudy Day			Grand Mean
	Morning	Afternoon	Evening	Morning	Afternoon	Evening	
Outside	1135.593	1657.642	355.209	387.501	602.779	215.278	725.667 (100%)
One layer of mesh net	882.641	1280.905	236.806	279.862	452.084	150.695	547.166 (75.39%)
Two layers of mesh net	552.015	865.877	166.641	193.750	367.762	34.170	363.369 (50.07%)

* Mean of four measurements

** Light intensity within the cage expressed as a % of light intensity outside

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