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Short Communication

Light energy efficiency in soybean (*Glycine max* (L) Merr.)

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A field experiment was carried out on the research farm of the Punjab Agricultural University, Ludhiana during 1993-94 and 1994-95 *kharif* seasons. The soil is *typic ustochrepts* and loamy sand in texture with bulk density of 1.58 g cm^{-3}. Soils were slightly alkaline in reaction with 8.1. pH. It is low in organic carbon (0.24%) and available nitrogen (220 kg ha^{-1}) and medium in available P (17.7 kg ha^{-1}) and potassium (160 kg ha^{-1}). The low electrical conductivity (0.20 dsm^{-1}) shows that the soils are free from salt problems

The experiments were of split-plot design with combination of two levels each of *Bradyrhizobium* inoculation (with vs. without) and weed control (Pendimethalin @ 0.5 kg ha^{-1} pre-emergence vs. two hand weedings at 15 and 35 days after sowing (DAS) in main plots and six levels of nitrogen schedules (0, 30, 60 and 90 kg ha^{-1} at sowing, 30 + 30 kg ha^{-1} at sowing and flowering, and 30 + 30 + 30 kg ha^{-1} at sowing, flowering and podding) in subplots with four replications. Soybean (cv. PK 416) seeds were inoculated as per treatment with charcoal based *Bradyrhizobium* japonicum culture containing 10^7 cells g^{-1} as per standard procedure (Vincent, 1970). Uniform dose of 80 kg P_2O_5 ha^{-1} was applied without any potassium. The crop was sown on 13th and 15th June in 1993 and 1994 seasons respectively at a row spacing of 45 cm using seed rate of 87.5 kg ha^{-1} under irrigated condition. The crop was harvested on 8th and 11th November in the two seasons respectively. Wheat crop was grown in residual fertility after soybean in 1994 and 1995 to neutralise the effect of treatments.

Dry matter accumulation at maximum grand growth stage was computed by destructive method from 5 plants earmarked from the middle of the experimental plot and leaf area index (LAI) were determined using laser leaf area meter at 12 weeks after sowing (WAS). Nitrogen concentration in plant was determined by using Humphries, 1956 (Kjedahl method). N removal by the crop was computed by multiplying N concentration with that of dry matter accumulation (seed vs. haulm as the case may be) and was expressed in $kgha^{-1}$.

The incoming radiation was measured using Swissteco Australian Pyranometer connected to a digital multivoltmeter at 1 meter above the crop canopy and at ground level between 1230 and 1400 hours. Albedo was measured at a height of 1 meter above the crop canopy by inverting the Pyranometer. Absorbance (A) is derived as A= 100 - R - T and per cent interception was estimated.

The data collected on various characters were statistically analysed according to the procedure laid down by Cochron and Cox (1963).

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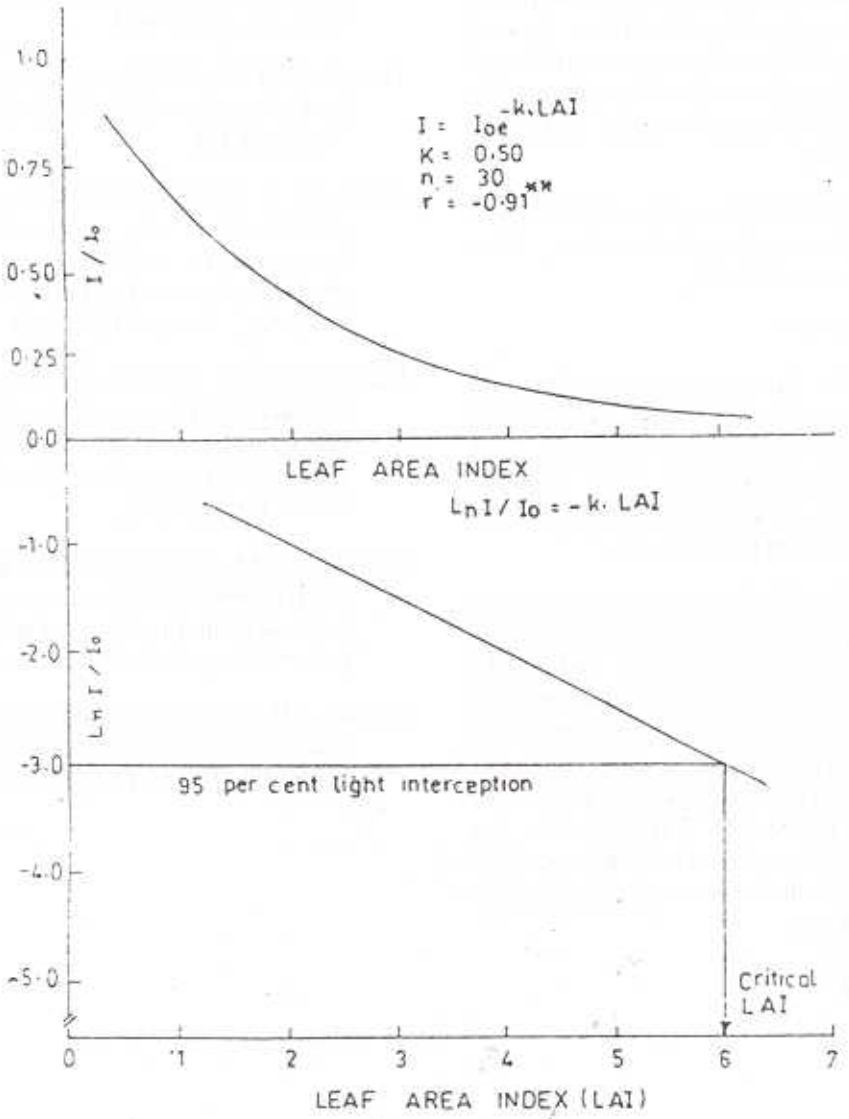

Fig. 1 : Light penetration as a function of LAI for soybean.

Significant positive correlations between solar radiation interception with LAI_{max} (r = 0.91), with dry matter at LAI_{max} stage (r = 0.74) and seed yield (r = 0.76) were also computed suggesting the linear type of relationship between above parameters with seed yield. Similar results were obtained by Shibles and Weber (1969) and Jeffer and Shibles (1969).

The extintition coefficient (K) was worked out according to Lambert - Beer extinction law as follows

$$I = I_0 e^{-K \cdot LAI}$$

where, I = Radiation at a particular height of the crop canopy (at bottom of the crop) Io = Radiation above the crop canopy (at 1 meter above the average crop canopy) K = Extinetion coefficient which is a function of light intercepted per unit LAI.

The ratio of radiation penetration (I) to the total radiation at the top of the crop canopy (I_0) plotted against the LAI (Fig. 1) showed a straight line with K value of 0.5 which indicate the role of higher radiation interception for improving dry matter and seed yield with increasing LAI of the crop as the critical LAI was found to be 6.0. Furthermore, the significant high correlation exists between LAI versus I/I_0 indicate the potential role of LAI in yield formations.

REFFERENCES

Cochran, W. C. and Cox, C.M. 1963. Experimental designs : John wiley and sons. Ine. New York.

Humphries, E. C. 1956. Integrated component and ash analysis. PP. 468-502. Springer Verlag. Berlin.

Jeffers, D. L. and Shibles, R. M. 1969. Some effects of leaf area, solar radiation, air temperature and variety on net photosynthesis in field grown soybean. *Crop Sci.*, 10(6) : 7623-7624.

Kanda, M. 1975. Efficiency of solar energy utilisation. In Crop productivity and solar energy utilisation in various climate of Japan (Y. Murata ed.) JIBP Synthesis, Vol II. Pp. 262-265.

Shibles, R.M. and Weber, C.R. 1969. Interception of solar radiation and dry matter production by various planting pattern. *Crop Sci.*, 6 : 55-59.

Vincent, J.M. 1970. A manual for the practical study of root nodule bacteria. Blackwell Scientific Oxford, U.K. Pp. 73-104.