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SHORT COMMUNICATIONS

Prediction of Leaf Area Index in Soya bean (*Glycine max*. (L.) Merrill)

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Leaf area index is an important input in various transpiration models, as well as models predicting plant photosynthetic rates. Characterization of crop growth as affected by various treatments is greatly facilitated with the use of leaf area index values (Sivakumar and Shaw, 1978). Determination of leaf area index has involved several methods which included blue print and planimetering, area photometer, linear dimensions, graded standards, dot counting, disc punching, light interception and use of electronic foliometers (Francis, 1969; Hatfield, Stanley and Carlson, 1976; McKee, 1964; Marshall, 1968; Wiersma and Bailey, 1975; and Williams, 1954).

Hatfield *et al*., (1976) reported on the accuracy and precision in measuring leaf areas with an electronic foliometer. Electronic foliometers provide accurate measurements of leaf area, but the high costs involved are prohibitive and measuring leaf areas of a large number of plants is time consuming. It would be highly desirable if leaf area could be predicted from more easily available measurements. Robinson and Messengale (1967) showed that leaf weight could be used to determine leaf area in alfalfa. In the present study, the possibility of predicting leaf area index in soybeans (*Glycine max* (L.) Merrill) using other readily available growth measurements such as leaf dry weight and number of leaves is being explored.

The study was conducted in 1976 on Ida silt loam soil [fine, silty, mixed (calcareous) mesic family of Typic udorthents] at the Western Iowa Experimental Farm, Castana, Iowa. The experiment was laid out in a randomized block design with four replications. More complete details regarding soil physical and chemical characteristics, treatments etc., are given in an earlier study (Sivakumar, Taylor and Shaw, 1977).

Above ground whole plants were sampled at weekly intervals beginning at the 4-node stage. In all, 12 samples were obtained during the growing season. On each sampling date 10 plants were randomly selected from each replicate. Each plant was separated into leaves, stems, petioles, pods and seeds. Leaf area of each plant was measured with a LI-COR portable leaf area meter (LAMBDA Instruments Corporation, Lincoln, Nebraska). The number of leaflets on each plant was also counted at the same time. Plant parts were dried to constant weight in a forced draft oven at 65 °C and then weighed.

From the detailed data available at weekly intervals on leaf d. wt (LDW), leaflet number (LN) and leaf area per plant (LA) measured with an electronic foliometer, regression procedures were used to predict leaf area index.

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TABLE 1. *Relationship between Leaf Dry Weight* (LDW) *and Leaf Number* (LN) *and the Leaf Area* (LA) *as measured by the foliometer*

Dependent variable	n	Regression coefficients		S.E. of b_1	R^2	t test
		Intercept (b_0)	Slope (b_1)			
		cm²				
LA	79	238·16	171·67 (LDW)	6·57	0·90	26·14**
LA	79	− 561·27	54·04 (LN)	1·82	0·92	29·71**

** Significance at the 1 per cent level.

Table 1 shows the relationship of LA to LDW and LN. Each of the 79 data values used in drawing the regression relationship is the average of ten plants. The linear regression of leaf area on leaf d. wt was highly significant. Such a relationship was also obtained by Koller (1972). It is obvious that leaf area per plant is closely related to the number of leaflets per plant. Linear regression is again highly significant.

Measured leaf area per plant is fitted against leaf d. wt and number of leaflets per plant using multiple regression. The prediction equation is:

$$\text{LA} = -286{\cdot}7 + 80{\cdot}3\,(\text{LDW}) + 31{\cdot}5\,(\text{LN})$$
$$R^2 = 0{\cdot}96 \quad \text{S.E. of } b_1 = 10{\cdot}20 \quad \text{S.E. of } b_2 = 3{\cdot}17$$
$$P < 0{\cdot}0001.$$

It is evident that leaf area index could be accurately predicted using the more easily available measurements. A plot of the predicted leaf area index against measured leaf area index for the 12 sampling times under consideration (Fig. 1) shows that the prediction equation is very useful to provide leaf area index values well within the errors of measurement.

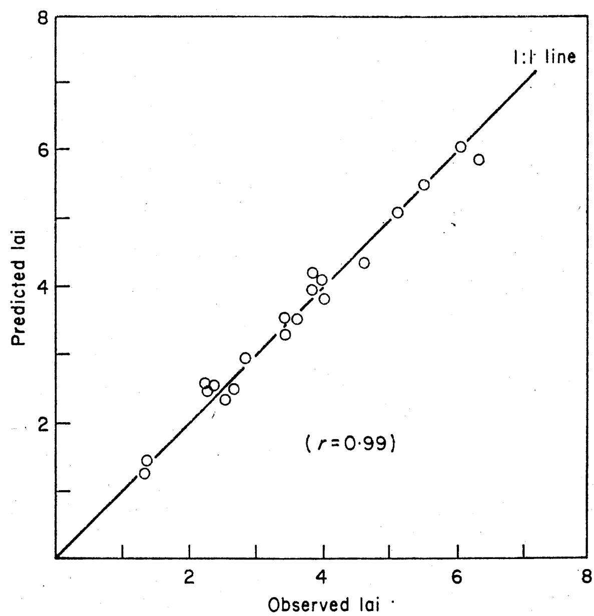

FIG. 1. Plot of the predicted leaf area index as compared to the observed leaf area index.

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