GAU Res. J. 1993, 19 (1) : 120-122

Prediction of Leaf Area Index of Cotton Hybrid 4 Using Non-Destructive Variables

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ABSTRACT

A model for predicting leaf area index of cotton hybrid 4 is developed using non-destructive type of variables. The commercial crop was grown at 120 cm x 60 cm spacing. The number of leaves per plant (NOL), leaf weight (LW) and leaf area index (LAI) showed quadratic trend due to stages of measurement (days after sowing, D). The equation derived was LÂI = 0.5595 + 0.0085 NOL - 0.0098 D. It accounted 92 per cent variation in LAI.

(Received on 28th Aug. 1989)

INTRODUCTION

Leaf Area Index (LAI) is one of the important crop growth parameters having direct positive influence on crop yield. It could also be utilized to determine total vegetation of the crop like cotton for which insecticidal spray has become a must. Knowing the total vegetation, one can estimate precisely the quantity of insecticides to be sprayed at a given growth stage of the crop and thereby minimise cost of production as well as pollution. The estimation of LAI consumes lot of time. While generating information on LAI one has to pluck all the leaves of plants which result into poor plant growth affecting crop yield. An attempt was made to develop a statistical model to predict LAI based on variables which are non-destructive in nature.

MATERIALS AND METHODS

Cotton Hybrid 4 was planted in about 0.15 hectare at 120 cm x 60 cm spacing during 1985-86 at the Plant Breeding Rsesarch Farm, GAU, Anand. The crop cultivation practices including plant protection measures in vogue were followed. The cropped field was divided into four blocks. Each block was divided into nine plots for collecting observations at nine growth stages of crop (30, 45, 60, 75, 90, 120, 150, 180 and 210 days after sowing). At each stage, four plots (one from each block) were selected at random for the purpose. The competitive plants from these plots were cut from ground level and brought to the laboratory. The leaves of each plant were plucked and total leaf area per plant was determined using automatic Leaf Area Meter (Model LI 3000; accuracy ± 2%).

The LAI was worked out by taking ratio of total leaf area per plant to the total area of the groud surface per plant (Watson, 1958). The green leaf weight (leaf weight) of all the leaves of each plant was recorded in gramme (g) after completing leaf area measurement.

RESULTS AND DISCUSSION

The results (Table 1) showed significant variation in number of leaves per plant (NOL), Leaf area (LA), Leaf area index (LAI) and Leaf weight (LW) due to stages of measurement. The mean values of each character increased upto 120 days of sowing, then after they showed decreasing trend. These results are akin to those reported by Anonymous (1985-86) and El-Shaer *et al.*, (1979). The inter-character association indicated that the LAI had positive significant high association with NOL (r = 0.8596) and LW (r = 0.9912), while its association with time trend (stages of measurement) was positive but not significant (r = 0.2550).

Further analysis showed that linear as well as quadratic effects were significant for NOL due to stages of measurement. The response model accounted 84 per cent variation in NOL. The LA, LAI and LW showed significant quadratic trend accounting 76, 76

TABLE 1

Mean values of various characters of Cotton Hybrid 4.

Stages (days after sowing)	*No. of plants studied*	*Number of leaves*	*Leaf area (sq. cm.)*	*Leaf area index*	*Leaf weight (g)*
D		*NOL*	*LA*	*LAI*	*LW*
30	38	8.7	321	0.04	7.9
45	32	34.7	2015	0.28	43.4
60	31	121.0	8045	1.12	166.6
75	30	135.2	8411	1.17	190.0
90	20	218.4	14553	2.02	336.4
120	16	477.7	25644	3.56	681.0
150	16	277.0	13046	1.81	359.4
180	16	225.0	8604	1.19	244.0
210	16	165.0	3068	0.63	140.6
Trend	Linear	*	NS	NS	NS
	Quadratic	**	**	**	**
	b1	9.25	529.3	0.074	13.55
	b2	–0.03	–2.1	–0.0003	–0.05
	R^2	0.84	0.76	0.76	0.74

Legend : * and ** indicate significant at 5 and 1 per cent level respectively.

and 74 per cent variation respectively. The LAI showed significant quadratic response due to stages of measurement (D) with R^2 = 76 per cent. The leaf weight could be utilized for predicting LAI with very high predictability (R^2 = 98 per cent). But leaf weight is destructive type of variable. For improving efficiency of prediction, two variables (NOL and D) were used in generating prediction model for LAI. The equation obtained was $\hat{LAI}$ = 0.5595 + 0.0085 NOL - 0.0098 D (R^2 = 92 per cent).

The R^2 for this equation is quite high. The other advantages of this prediction model is that it is based on non-destructive type of variables. It involves number of leaves per plant at D days after sowing of crop. Both variables could be counted easily even by farmers. Similar results were reported by Hunsigi (1976).

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