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SPECTRAL RESPONSE OF DETERMINATE AND INDETERMINATE VARIETIES OF RED GRAM

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ABSTRACT

A field experiment was conducted to study the spectral response pattern of determinate varieties (Vamban 1, ICPL 87 and CORG 9301) and indeterminate varieties (Co.5 and ICPL 88027) of red gram. The spectral reflectance increased steadily from 45 DAS upto 75 DAS and decreased thereafter. Indeterminate varieties exhibited higher reflectance than determinate varieties of red gram throughout the growing period. Infrared band and spectral vegetation indices like IR/R, IR-R, Perpendicular vegetation index (PVI) and Greeness Index (GI) were effective in discriminating the red gram varieties at 45 DAS.

INTRODUCTION

Remore sensing of earth resources utilises electromagnetic energy which ranges from short wavelength ultraviolet to longer wavelength active radar and passive microwave systems. All of these wavelengths are applicable to and useful for agricultural remote sensing. Current and prospective applications of remotely sensed data in agriculture need spectral-plant parametric functional relations of economically improtant crops. Most of the spectral response studies have been carried out for cereal crops like rice, wheat, sorghum etc., but the studies on pulse crops are meagre. The present investigation was, therefore, carried out to study the spectral response of red gram (determinate and indeterminate varieties) to find out the feasibility of discriminating the different cultivars by using remote sensing techniques.

MATERIALS AND METHODS

A field experiment in Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore was conducted during kharif season, 1995 in the soil belonging to fine loamy, mixed, isohyperthermic, Typic Haplustalfs. The experiment was laid out in randomised block design with four replications. The plot size was 4 x 2.7 m and the spacing was 45 x 20 cm. Three determinate varieties viz., Vamban-1, ICPL 87 and CORG 9301 and two indeterminate varieties of red gram (CO 5 and ICPL 88027) were taken up for the study. Normal package of practices were followed without imposing other treatments.

A Multiband Ground Truth Radiometer (Optomech Model 041) with four bands of spectral region corresponding to IRS IA/IB (blue : 450 - 520, green 520-590, red 620-880 and infrared 770-860 nm) was employed in recording spectral data of the cultivars at fortnightly interval from 45 DAS to 105 DAS. Biometric data were also collected from the experimental plots on the days when the spectral readings were recorded. The spectral readings of individual bands were converted into spectral reflectance percentage. Besides, the spectral reflectance percentages were converted into ratios and transformations of band means like IR/R, IR-R, Normalised Difference Vegetation Index (NDVI), Transformed Vegetation Index (TVI), Perpendicular Vegetation Index (PVI) and Greeness Index (GI). The spectral reflectance percentage of individual bands and the spectral vegetation indices were used for discrimination of red gram varieties.

RESULTS AND DISCUSSION

Spectral response of red gram

The spectral reflectance percentage values of determinate and inderminate varieties of redgram revealed that indeterminate varieties recorded higher values than determinate varieties throughout growth period (Table 1). This was due to variation in crop growth variables like plant height, LAI, chlorophyll content, drymatter production. The reflectance increased steadily upto 75 DAS, and decreased thereafter as the crop was reaching maturity stage. The discrimination among the cultivars was conspicuous in all the bands (blue, green, red and infra red) only at 45 DAS. Therefore 45 DAS was considered as the appropriate stage for

Table 1. Spectral reflectance percentage values of determinate and indeterminate varieties of red gram

Varieties	45 DAS				60 DAS				75 DAS				90 DAS				105 DAS			
	B	G	R	IR	B	G	R	IR	B	G	R	IR	B	G	R	IR	B	G	R	IR
Determinate varieties																				
Vamban-1	8.00	11.68	11.29	39.49	12.60	16.04	14.70	54.55	27.55	22.44	20.83	74.35	18.72	16.20	15.92	41.33	10.52	12.28	11.58	31.02
ICPL-87	7.05	10.36	16.45	38.35	12.01	15.15	17.91	53.39	24.58	22.69	21.82	71.25	17.86	14.14	13.76	40.28	10.63	8.95	7.24	32.36
CoRG 9301	8.00	11.77	16.29	34.76	10.25	19.72	13.28	58.40	24.57	22.92	20.95	67.91	18.40	16.78	14.06	42.82	10.42	8.81	7.73	30.98
Indeterminate varieties																				
Co-5	10.64	13.96	15.95	41.78	13.27	15.28	18.29	58.79	29.61	24.43	22.83	83.05	20.12	20.01	16.66	47.17	11.21	9.21	8.53	35.36
ICPL-88027	10.12	13.70	14.67	42.42	11.97	13.12	16.04	59.02	27.86	21.08	24.98	80.73	18.89	18.77	15.56	49.53	10.58	9.12	8.27	36.83
SED	1.421	1.603	1.708	1.904	1.255	1.018	1.113	1.100	1.403	1.203	1.282	1.13	1.013	1.113	1.024	1.423	1.207	1.003	1.321	1.417
CD (0.05)	2.896	3.249	3.428	4.028	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

B - Blue band ; G - Green band ; R - Red band ; IR - Infrared band.

Table 2. Agronomic variables of determinate and indeterminate types of red gram recorded at 45 DAS

Varieties	Plant height (cm)	LAI	DMP (mg ha^{-1})	Chlorophyll content (mg g^{-1})
Determinate varieties				
Vamban-I	28.56	1.48	2.68	0.93
ICPL-87	30.41	1.45	3.37	0.88
CoRG 9301	34.67	1.52	2.68	1.03
Indeterminate varieties				
Co-5	32.25	1.70	3.42	1.07
ICPL-88027	28.52	1.50	2.78	0.82
SED	0.995	2.08	0.584	0.155
CD (0.05)	2.168*	4.53**	NS	3.366*

discrimination of determinate and indeterminate varieties of red gram.

Spectral reflectance and agronomic variables

An analysis was made on the agronomic variables which caused the spectral differences of determinate and indeterminate red gram varieties at 45 DAS. It was found that plant growth variables like plant height, leaf area index and chlorophyll content were responsible for spectral differences among the different cultivars of red gram (Table 2). Similar findings were reported for wheat crop by Hinzman *et al.*,. (1986).

Vegetation indices and varietal discrimination

Spectral vegetation indices are good indicators of crop growth conditions (Sundara sarma and DAS, 1994). Hence, the feasibility of differentiating the red gram varieties was attempted by using the spectral vegetation indices at 45 DAS.

Table 3. Vegetation indices of determinate and indeterminate varieties of red gram computed at 45 DAS.

Varieties	IR/R	IR-R	NDVI	TVI	PVI	GI
Determinate varieties						
Vamban-I	20.20	2.497	0.453	0.927	16.19	19.02
ICPL-87	24.17	2.273	0.377	0.936	16.98	18.36
CoRG 9301	20.90	2.222	0.379	0.937	19.98	16.19
Indeterminate varieties						
Co-5	25.07	2.565	0.439	0.969	19.77	19.59
ICPL-88027	24.47	2.630	0.449	0.974	19.14	20.16
SED	2.98	0.84	0.06	0.04	1.01	1.09
CD (0.05)	5.23	1.86	0.13	0.09	2.21	2.49

Among these indices, discrimination effect was more pronounced with vegetation indices like IR/R, IR-R, Perpendicular vegetation index (PVI) and Greeness index (GI) (Table 3). These findings agree with the reports of Patel *et al.*, (1995). Higher values of vegetation indices were recorded for indeterminate varieties compared to indeterminate varieties as in the case of reflectance of spectral bands.

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CYTOZYME FOR INCREASED YIELD OF GROUNDNUT

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ABSTRACT

Foliar application of cytozyme to groundnut crop at peg formation stage at 0.05 percent concentration gave an increased pod yield of 18.5 per cent over control. This spray application also resulted in 23.0 percent increase in LAI, 27.9 percent increase in chlorophyll content and significant increase is macro and micronutrient uptake. The oil content of kereal also increased by 7.1 per cent over control.

Cytozyme a bioproduct recently introduced in the market is a crop growth regulator formulation containing enzymes, hormones, micronutrients and amino acids. Though its positive influence on