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VARIETAL DISCRIMINATION OF KHARIF RICE VARIETIES USING REMOTE SENSING TECHNIQUES

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ABSTRACT

Field experiments were conducted during 1992 and 1993 to study the possibility of discriminating *kharif* rice varieties using ground based remote sensing technique. Eight short duration varieties, *viz.*, ASD 18, ADT 36, IR 50, IR 60, IR 64, JJ 92, TKM 9 and CO 37 which are predominantly grown in the command areas of Tamil Nadu were considered for the study. Spectral reflectance and crop biometrics were recorded at fortnightly intervals from 30 DAT upto harvest. The results revealed that four rice varieties *viz.*, ADT 36, IR 50, IR 60 and JJ 92 alone could be discriminated from each other, whereas the other four rice varieties could not be discriminated because the spectral reflectance of these varieties were closer to one another. The crop biometrics like LAI, chlorophyll content, leaf nitrogen content and biomass production were responsible for the varietal discrimination. The discrimination was well pronounced in red and infrared bands and also in vegetation indices like IR/R and IR-R.

KEWY WORDS : Spectral reflectance, agronomic variables, remote sensing, rice varieties

Recent developments in the field of remote sensing have opened new avenues in the field of agriculture for getting information about crop area, crop condition etc. The need for timely information on world wide or nation wide crop production and crop area estimation signifies the role of remote sensing technique is nearing operational use for crop area estimation especially for paddy, wheat and sorghum. The reflectance of an object varies considerably with wavelength and are characteristic of plant, like thumb impressions of human being (Pishorathy, 1988). The spectral characteristics of a feature may change due to its temporal effects (Sharma *et al.*, 1986) and also with plant species (Thomas *et al.*, 1967). So, accurate crop identification from remote sensing signals is dependent on the knowledge of difference in the characters of reflectance from various crop canopies. And in estimating the crop yield, information on area covered by individual cultivars rather than the crop as a whole will be of more use since the yield potentiality will vary with varieties. Hence, an attempt was made to study the possibilities of discriminating the rice cultivars using remote sensing technique.

MATERIALS AND METHODS

Field experiments were conducted in the wet lands of Tamil Nadu Agricultural University, Coimbatore during 1992 and 1993 *kharif* season. Short duration rice varieties predominantly grown in the various command areas of Tamil Nadu *viz.*, ASD 18, ADT 36, IR 50, IR 60, IR 64, JJ 92, TKM 9 and CO 37 were considered for the study. The varieties were raised with normal package of practices being followed by farmers without imposing any treatments. Spectral measurements were recorded between 0930 and 1130 hours at active tillering (30 DAT), panicle initiation (45 DAT), flowering (60 DAT), grain maturation (75 DAT) and at harvest, using a multi band ground truth radiometer (model 041) in four bands of spectral region *viz.*, 450-520, 520-590, 620-880 and 770-860 nm. $BaSO_4$ panel was used as standard for reflectance. Simultaneously, all the crop biometrics (plant height, tiller number, LAI) including leaf N content and chlorophyll content were measured.

Table 1. Stage wise spectral reflectance percentage of *kharif* rice varieties

Varieties	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT
ASD 18	24.93	35.26	65.9	58.13	53.84
ADT 36	24.99	30.34	73.82	63.93	57.49
IR 50	20.35	34.24	71.37	62.23	56.50
IR 60	23.82	32.77	59.91	56.74	49.20
IR 64	24.47	34.22	84.24	66.34	64.66
JJ 92	21.38	30.41	67.60	58.14	54.57
TKM 9	21.97	33.14	61.71	54.70	46.59
CO 37	25.82	34.94	76.48	69.21	61.20
SEd	1.98	2.21	2.80	2.77	2.64
CD (0.05)	4.25	4.73	6.06	5.93	5.64

The spectral data were converted to percentage of reflectance using barium sulphate reading as standard. In addition the spectral data were analysed as ratios and transformations of the band means *viz.*, IR-R, IR/R, Normalised difference (ND), Transformed vegetation index (TVI) and Perpendicular vegetation index (PVI).

RESULTS AND DISCUSSION

Spectral reflectance and agronomic variables

The spectral reflectance of all the eight rice varieties tested in the experiment steadily increased upto flowering stage and declined thereafter. The reflecting power of the rice varieties is influenced by the foliage density, vigour, chlorophyll and leaf nitrogen contents. This resulted in high spectral reflectance at maturity stage (Naveen Kalra, 1990). The statistical analysis of stage wise reflectance of the rice varieties revealed that the reflectance is not significant at active tillering and panicle initiation stages. The reflectance was significant at flowering, grain maturation and at harvest stages. Therefore the flowering stage is the early period of discrimination of *kharif* rice varieties during their growth.

The spectral reflectance measured at flowering stage was used as the criteria for discriminating *kharif* rice varieties. Of the eight varieties tried in the present study, four varieties *viz.*, ADT 36, IR 60, IR 64 and JJ 92 significantly differed from each other for their spectral reflectance data (Table 1).

An analysis was made on the agronomic variables, which caused the variations in the spectral reflectance of rice varieties ADT 36, IR 69 and JJ 92. (Table 2).

The results indicated that plant height and tiller number did not influence the spectral reflectance of the rice varieties. But the other agronomic variables such as chlorophyll content, leaf nitrogen, LAI and biomass production influenced the spectral reflectance of the rice varieties (Hinzman *et al.*, 1986). The grain and straw yields also differed for each rice variety but their influence on reflectance was not included in the present study and it has little practical utility.

Spectral reflectance and bands

Of the four spectral bands, red (620-680 mm) and infra red (770-860 nm) were found to discriminate the rice varieties, where as in blue (450-520 nm) and green bands (520-590 nm) there was no significant difference even at the flowering stage with high spectral reflectance (Table 3).

At flowering stage the per cent reflectance was low in the red band and high in the other three bands (blue, green and infra red bands) due to absorption in red band and reflectance in infra red bands (Mahey *et al.* 1990).

Varietal discrimination and vegetation indices

The vegetation indices are good indicators of crop growth and condition. Consequent to variation in spectral reflectance the vegetation indices like IR/R, IR-R, ND, TVI and PVI showed significant difference among varieties (Table 4). All the vegetation indices showed an increasing trend upto flowering stage. The significant difference for variation was observed only at flowering stage. Among these indices the discrimination effect was more prominent with the vegetation indices like IR/R and IR-R.

Table 2. Growth characteristics of *kharif* rice varieties at flowering stage (60 DAT)

Varieties	Plant height (cm)	Tiller count Per m^2	LAI	DMP (t/ha)	Chlorophyll content (mg/g)	N content (%)	Grain yield (t/ha)	Straw yield (t/ha)
ASD 18	70.7	13.5	4.767	6.727	2.033	2.413	4.047	6.053
ADT 36	74.1	15.7	4.967	7.403	2.310	2.651	4.573	6.987
IR 50	69.5	13.6	4.407	6.823	2.053	2.372	4.583	6.670
IR 60	64.4	11.0	4.087	6.603	1.993	2.513	4.103	6.163
IR 64	79.1	18.9	5.987	7.853	2.527	2.721	4.823	7.403
JJ 92	69.1	13.3	4.520	6.987	2.127	2.573	4.253	6.050
TKM 9	71.7	15.2	4.177	6.683	2.113	2.430	4.050	6.023
CO 37	69.4	13.2	4.450	7.237	2.147	2.520	4.670	6.397
SEd	1.9	1.0	0.198	0.162	0.056	0.021	0.052	0.150
CD (0.05)	4.2	2.2	0.424	0.348	0.119	0.047	0.111	0.323

Table 3. Spectral reflectance (%) in four bands for *kharif* rice varieties at flowering stage (60 DAT)

Varieties	Blue	Green	Red	Infra red
ASD 18	9.87	11.86	11.21	65.90
ADT 36	9.68	12.05	7.24	73.82
IR 50	10.37	12.78	10.87	71.37
IR 60	9.23	12.30	14.34	59.91
IR 64	11.84	13.50	5.71	84.21
JJ 92	10.57	11.22	10.84	67.60
TKM 9	9.61	11.35	12.07	61.71
CO 37	10.56	13.17	6.36	76.48
SEd	1.22	1.13	0.71	2.82
CD (0.05)	2.73	2.43	1.52	6.06

Table 4. Vegetation indices for *kharif* rice varieties computed at flowering stage (60 DAT)

Varieties	IR/R	IR-R	ND	TVI	PVI
ASD 18	8.59	65.52	0.79	1.14	51.97
ADT 36	9.98	68.68	0.72	1.10	51.41
IR 50	5.99	55.19	0.71	1.10	48.84
IR 60	6.01	55.52	0.43	0.96	48.41
IR 64	11.76	77.00	0.84	1.16	52.03
JJ 92	7.97	63.32	0.58	1.03	47.57
TKM 9	8.77	62.00	0.58	1.04	48.95
CO 37	8.33	67.01	0.79	1.13	53.79
SEd	0.82	2.95	0.05	0.03	3.04
CD (0.05)	1.75	6.32	0.11	0.06	6.51

SUMMARY

The spectral studies conducted with ground truth radiometer demonstrated the potentiality of discriminating important *kharif* rice varieties *viz.,* ADT 36, IR 50, IR 60 and JJ 92. The best period of discriminating the rice varieties is the flowering stage (60 DAT). Red and infrared bands and vegetation indices like IR/R and IR-R were more effective in the discrimination study. However, these findings have to be confirmed with satellite data before satellite based remote sensing is employed for the identification of rice varieties in the command areas.

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GENETIC ANALYSIS IN A DIALLEL CROSS OF INBRED LINES OF CASSAVA

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ABSTRACT

A study to determine gene action, heritability and number of effective genes controlling 13 traits utilizing Jinks - Hayman diallel analysis of the populations raised by a 6x6 diallel cross of fourth generation inbred lines of cassava showed that overdominance governed most of the traits including yield and yield components. The number of gene groups controlling various traits was estimated and root yield was found to be controlled by 3 gene groups. Very low narrow sense heritability obtained for yield and its components also revealed the preponderance of non-additive gene action. The (Vr, Wr graph confirmed the role of overdominance for yield and its major components. The standardised deviation graph was used to identify superior parents. The study indicated the possibility of genetic improvement in cassava through heterosis breeding.

KEY WORDS : Cassava, diallel, overdominance, yield components