

## SPAD 502 and LCC values of wetseeded hybrid rice CORH 2 influenced by seed rates and nitrogen management

Joseph, M\*, V. Veerabadrán and M. Hemalatha

Department of Agronomy, Agricultural College and Research Institute, T.N.A.U., MADURAI (T. N.) INDIA

### ABSTRACT

Field studies were conducted at Agricultural College and Research Institute, Madurai during *rabi* 1999-2000 and 2000-2001 to find out the effect seed rates, dhaincha intercropping and urea applicator on leaf colour intensity which is directly related to leaf chlorophyll content of hybrid rice measured by SPAD 502 and Leaf Colour Chart. The experiments were laid out in split plot design replicated thrice. Seed rates of 12, 16, 20 and 24 kg/ha were compared with and without green manure dhaincha intercropping in the main plots. Application of 75 per cent and 100 per cent N through urea applicator compared with application of 100 per cent N as broadcast formed the sub plot treatments. At all stages SPAD 502 reading remained unaffected by varying seed rates, but distinctly differed between dhaincha intercropped rice and sole rice. Nitrogen management also had a significant effect on this parameter. Leaf Colour Chart (LCC) values varied mainly due to dhaincha intercropping and N management and was not affected by seed rate. Positive and significant correlation was seen between LCC value and SPAD 502 value with grain yield. Grain yield was higher in seed rate of 24 kg/ha with dhaincha intercropping (6600 and 6421 kg/ha) during the two years. Application of 100 per cent N through urea applicator recorded the higher grain yield. Sole cropping or dhaincha intercropping using the same seed rate of rice did not seem to affect harvest index of hybrid rice.

**Key words :** Seed rate, N management, SPAD 502, LCC value, Hybrid rice yield.

### INTRODUCTION

Paddy is a versatile crop in the sense that it is cultivated by different methods in various parts of the country. By and large, transplanting is the dominant system of rice culture in India. However, in recent years many factors such as scarcity and rising cost of labour, uncertainty in water release in canal etc., have encouraged many rice farmers to switch over from transplanted to wetseeding (De Datta and Flinn, 1986). Studies in Tamil Nadu have been conducted on wetseeding of conventional inbred rice varieties and the results have indicated the high yield potential of wetseeded rice system on par with or even higher than transplanted system (Rachel and Martin, 1995). However hybrid rice has not yet been tested under wetseeding in Tamil Nadu. The obvious reason for this is the non-availability of management technology package for wetseeded hybrid rice. Growing hybrid rice is a complex process since agronomic management of hybrid rice differs considerably from that of conventional inbred varieties. Among the agronomic requirement for successful hybrid rice culture, plant densities play an important role, which is the major yield determinant in any system of rice culture (Wahab, 1994). And also nutrient requirement of hybrid rice especially nitrogen is higher than that of conventional inbred varieties. Application of nitrogenous fertilizer at initial stages of crop growth is very essential in wetseeded rice. Though there are many methods available to analyse the plant nitrogen content, they are laborious and time consuming. To determine the N content, SPAD 502 and LCC (Leaf colour chart) are the modern technique employed to assess the N content. SPAD meter and LCC are portable diagnostic tools for maintaining plant N status *in situ* in field and to plan N application so as to synchronise with crop demand. (Balasubramanian *et al.*, 2000 a).

In this background, an investigation was carried out on seed rate, dhaincha intercropping and N management through urea application in the performance of wet seeded hybrid rice CORH 2.

### MATERIALS AND METHODS

Field experiments were conducted at Agricultural College and Research Institute, Madurai during *rabi* 1999-2000 and 2000-2001 to evaluate the effect of varying seed rates, dhaincha intercropping and N placement through urea applicator on the nitrogen content and

leaf colour intensity which is directly related to leaf chlorophyll content of hybrid rice CORH 2 measured by SPAD 502 and Leaf Colour Chart. The soil of the experimental fields was Typic haplustalf with a surface texture of sandy clay loam. The soil pH was 7.0 and 6.8 and low in available N, medium in available P and high in available K. The organic carbon content was 0.43 and 0.41 per cent in the two experimental seasons respectively. The experiments were laid out in split plot design replicated thrice. Rice seed rates of 12, 16, 20 and 24 kg/ha were compared with and without dhaincha intercropping in the main plots. Application of 75 per cent and 100 per cent Nitrogen (N) through urea applicator and application of 100 per cent N as broadcasting formed the sub plot treatments. Wetseeding of hybrid rice and green manure were sown by using paddy cum dhaincha drum seeder. Dhaincha seeds were sown in 25 cm inter space between rice rows and the green manure biomass was incorporated on 45 DAS using Cono weeder. N was applied as urea as per the treatment in four splits at 30, 45, 70 and 95 DAS. Phosphorus was applied as uniform basal and Potassium was applied along with first 3 splits of N. SPAD 502 (SPAD 502 - Soil Plant Analysis Development section, Minolta Camera Co. Ltd., Japan) measurements were made as described by Peng *et al.* (1993). A Leaf Colour Chart (LCC) developed from a Japanese prototype (Furuya, 1987) was used to record the leaf colour intensity which is directly related to leaf chlorophyll content and leaf nitrogen status. The different colour strips in LCC are numbered from one to six and the number of strips matching the colour of sampled leaf was noted as its LCC value. The reading was recorded on the upper most fully expanded leaves in five randomly selected plants at 60, 90 and 105 DAS.

### RESULTS AND DISCUSSION

#### SPAD 502 reading :

At all stages, SPAD 502 readings remained unaffected by varying seed rates, but distinctly differed between dhaincha intercropped rice and sole cropped rice. Irrespective of the seed rate, intercropping and incorporation of dhaincha in hybrid rice recorded significantly higher values of SPAD reading of 39.9 to 39.3 and 39.9 to 39.3 at 60 DAS, 42.4 to 41.6 and 42.4 to 41.5 at 90 DAS, 42.2 to 42.9 and 42.4 to 42.2 at 105 DAS for the two years respectively. In sole cropping the SPAD 502 recorded lower values during the two years (Table 1). SPAD threshold value for wetseeded rice has been fixed around 32 for inbred rice varieties (Balasubramanian *et al.* 2000 a). Nitrogen management also had a significant effect on SPAD value.

\* Author for correspondence : Sugarcane Research Station, Melalathur – 635 806. Gudiyattam Tk, Vellore Dt.

Table 1: Effect of seed rates, dhaincha intercropping and N management on SPAD 502 readings of hybrid rice

Treatments	SPAD 502 reading					
	1999-2000			2000-2001		
	60 DAS	90 DAS	105 DAS	60 DAS	90 DAS	105 DAS
M <sub>1</sub> – 24 kg seed rate (sole cropping)	34.8	38.1	39.1	34.5	37.9	39.1
M <sub>2</sub> - 20 kg seed rate (sole cropping)	35.3	38.6	39.9	35.1	38.5	39.9
M <sub>3</sub> –16 kg seed rate (sole cropping)	36.7	38.8	40.5	36.6	38.8	40.4
M <sub>4</sub> - 12 kg seed rate (sole cropping)	37.2	39.1	40.5	37.0	39.0	40.4
M <sub>5</sub> .24 kg seed rate + dhaincha intercropping	39.5	41.6	42.2	39.3	41.5	42.4
M <sub>6</sub> - 20 kg seed rate + dhaincha intercropping	39.5	42.1	42.9	39.3	42.1	42.8
M <sub>7</sub> - 16 kg seed rate + dhaincha intercropping	39.7	42.4	42.7	39.8	42.4	42.8
M <sub>8</sub> - 12 kg seed rate + dhaincha intercropping	39.9	42.4	42.9	39.9	42.1	43.2
SEd	0.9	1.1	1.0	1.0	1.0	1.0
CD (P=0.05)	2.0	2.3	2.2	2.1	2.2	2.2
S <sub>1</sub> – 75 % N (urea applicator)	36.6	39.1	39.6	36.4	38.9	39.7
S <sub>2</sub> – 100% N (urea applicator)	39.5	41.9	43.3	39.3	41.8	43.5
S <sub>3</sub> – 100 % N (broadcasting)	37.4	40.2	41.0	37.4	40.0	40.9
SEd	0.7	0.7	0.9	0.7	0.7	0.8
CD (P=0.05)	1.5	1.4	1.8	1.5	1.5	1.7

Application of 100 per cent N through urea applicator registered significantly higher SPAD reading of 39.5 and 39.3 at 60 DAS, 41.9 and 41.8 at 90 DAS and 43.3 and 43.5 at 105 DAS respectively for two years respectively. This indicated a higher leaf nitrogen concentration due to greater uptake of N by rice. Application of 75 per cent N through urea applicator recorded lower SPAD reading. Similar SPAD values of 34-37 were obtained in well fertilized rice hybrid at 30-90 days after planting. (Kumar *et al.* 1999).

#### Leaf Colour Chart (LCC):

Leaf colour chart varied mainly due to dhaincha intercropping and N management practices and was not affected by seed rate. At any stage of observation, LCC values recorded on hybrid rice were higher due to dhaincha intercropping and incorporation over sole cropping. At 60 DAS, LCC values of sole rice ranged from 3.50 to 3.75 whereas with dhaincha intercropping it increased from 4.00 to 4.25. Application of 100 per cent N through urea applicator recorded significantly higher LCC values of 4.50 at 60 DAS, 4.50 at 90 DAS and 5.0 at 105 DAS (Table 2). The suggested critical threshold value of LCC for wetseeded rice is 3 (Balasubramanian *et al.* 2000b). The high LCC values under this method of urea application confirm the higher leaf N content consequent on greater availability of N in soil and higher uptake by the crop.

#### Correlation between LCC/SPAD reading and grain yield:

A relationship was established between LCC/SPAD and grain yield of wetseeded hybrid rice (Table 3 and Fig 1a & 1b). Significant positive correlation coefficient (0.840) was noticed for LCC value with grain yield. Similarly the correlation between SPAD 502 and yield was also positive and significant with 'r' value of 0.870.

#### Grain yield:

Seeding at 24 kg/ha coupled with dhaincha intercropping produced higher grain yield of 6600 and 6421 kg/ha during the two years. Seeding at 20 kg/ha with dhaincha intercropping recorded grain yield of 6008 and 5782 kg/ha, which was at par with a higher seed rate of 24 kg/ha in sole crop (Table 4). Production of more panicles per unit area at higher plant densities associated with higher

seed rate led to a significant increase in grain yield with 24 kg/ha seed rate. Wahab (1994) also observed that yield was minimum at low level of seed rate in inbred rice varieties.

Rice intercropping with green manure yielded more than sole rice (6600 and 6421 kg/ha). The release of mineralized N from decomposing biomass of incorporated green manure during the peak period of absorption (60-80 DAS) by rice hybrid enabled greater absorption of nutrients resulting in improvement in yield attributes especially grain formation leading to higher grain yield in rice intercropped with dhaincha. *Sesbania aculeata* when harvested and incorporated at 45, 55 and 65 DAS, it produced 18, 28 and 37 t/ha of biomass equivalent to 98, 147 and 165 kg N/ha (Bharadwaj and Dev, 1985). Effect of green manuring with *Sesbania aculeata* in increasing grain yield has been reported in many studies of Manguiat *et al.* (1992) and Swarup, (1991).

Application of 100 per cent N through urea applicator recorded significantly higher grain yield of 5203 and 4939 kg/ha during the two years respectively. Devasenapathy and Palaniappan (1996) explained the increased availability of soil N with urea applicator, due to the inhibitive effect of higher  $\text{NH}_4^+$  N concentration on bacteria associated with de-nitrification losses of N. Thus a possible reduction in loss of applied fertilizers N through leaching, volatilization and denitrification due to band placement of N in reduced layer with urea applicator increased the availability of N for crop uptake. Seeding at 24 kg/ha with dhaincha intercropping and application of 100 per cent N through urea applicator recorded higher grain yield of 6992 and 6633 kg/ha during both years. It was followed by seeding at 24 kg/ha as sole rice crop and 100 per cent N through urea applicator which was comparable with seeding 20 kg coupled with dhaincha intercropping and 100 per cent N through urea applicator.

#### Harvest Index:

Harvest index improved with increasing seed rate in wetseeded hybrid rice. It increased from 0.39 at 12 kg ha<sup>-1</sup> seed rate to 0.45 kg ha<sup>-1</sup> seed rate in sole rice crop during 1999- 2000. In dhaincha intercropped rice also, it registered an increase from 0.40 at 12 kg ha<sup>-1</sup> seed rate to 0.45 at 24 kg ha<sup>-1</sup> seed rate in the same seed rate in the same year (Table 5). A similar trend was seen in

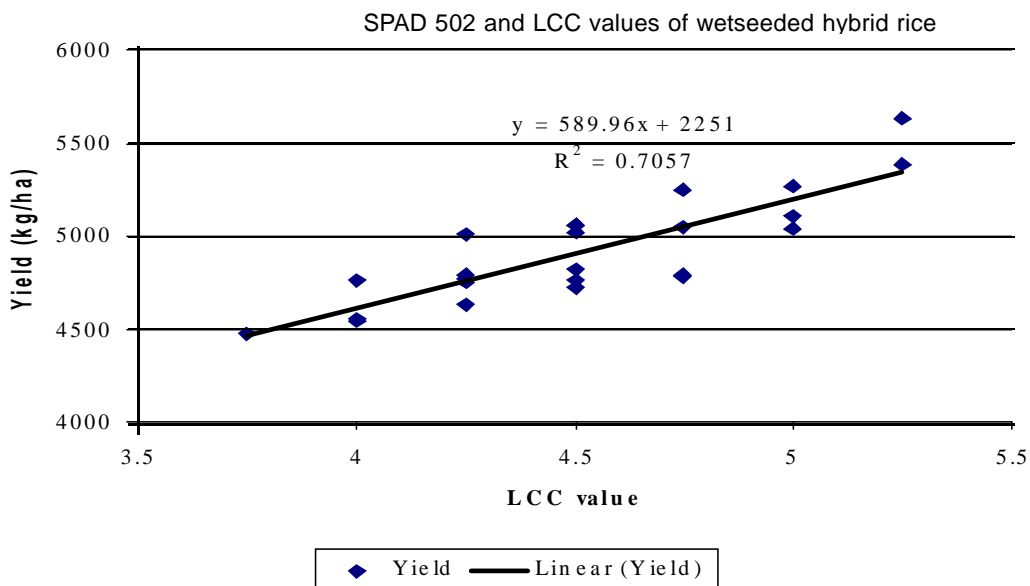


Fig. 1a : Relationship between LCC value and grain yield of hybrid rice.

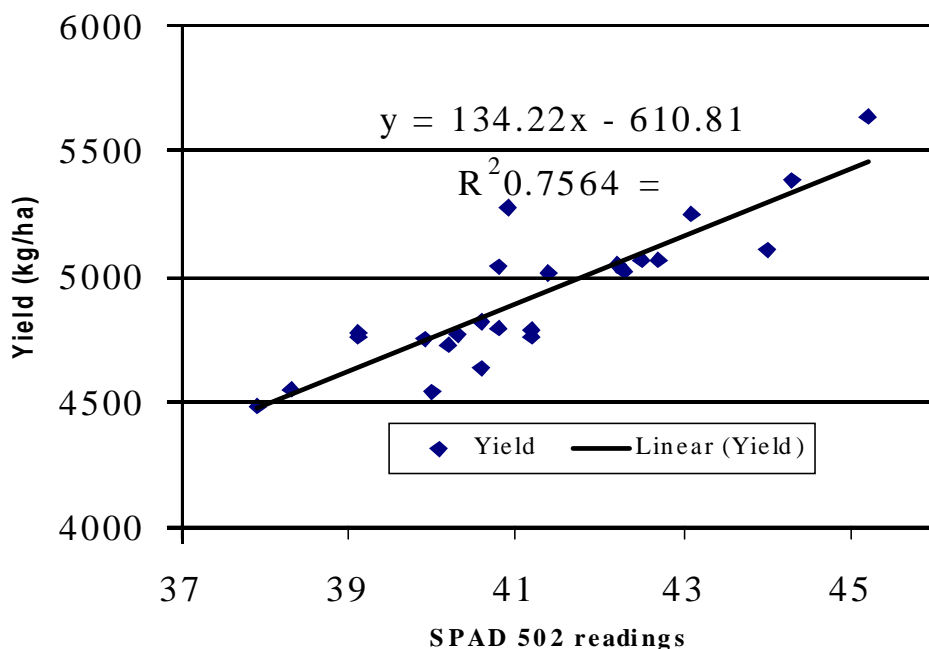


Fig. 1b : Relationship between SPAD reading and grain yield of hybrid rice.

Table 2 : Leaf Colour Chart value influenced by various seed rate, dhaincha intercropping and N management practices

Treatments	Leaf colour chart value		
	2000-2001		
	60 DAS	90 DAS	105 DAS
M <sub>1</sub> - 24 kg seed rate (sole cropping)	3.5	3.8	4.3
M <sub>2</sub> - 20 kg seed rate (sole cropping)	3.5	4.0	4.5
M <sub>3</sub> - 16 kg seed rate (sole cropping)	3.8	3.8	4.5
M <sub>4</sub> - 12 kg seed rate (sole cropping)	3.8	3.8	4.5
M <sub>5</sub> - 24 kg seed rate + dhaincha intercropping	4.0	4.0	4.5
M <sub>6</sub> - 20 kg seed rate + dhaincha intercropping	4.0	4.3	4.5
M <sub>7</sub> - 16 kg seed rate + dhaincha intercropping	4.3	4.3	4.8
M <sub>8</sub> - 12 kg seed rate + dhaincha intercropping	4.3	4.5	4.8
SEd	0.1	0.1	0.1
CD (P=0.05)	0.3	NS	NS
S <sub>1</sub> - 75 % N (urea applicator)	3.3	3.5	4.0
S <sub>2</sub> - 100 % N (urea applicator)	4.5	4.5	5.0
S <sub>3</sub> - 100 % N (broadcasting)	3.8	4.0	4.5
SEd	0.1	0.1	0.1
CD (P=0.05)	0.3	0.3	0.3

Table 3 : Correlation between LCC, SPAD 502 and grain yield of wetseeded hybrid rice

Characters	r	a	b	R <sup>2</sup>
LCC	0.84	2251	590	0.706
SPAD	0.87	-610.8	134.2	0.756

Note: Y= a+bx

Table 4 : Effect of seed rates with and without dhaincha intercropping and N management on grain yield of hybrid rice

Treatments	Grain yield (kg ha <sup>-1</sup> )																	
	1999-2000								2000-2001									
	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	M <sub>5</sub>	M <sub>6</sub>	M <sub>7</sub>	M <sub>8</sub>	Mean	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	M <sub>5</sub>	M <sub>6</sub>	M <sub>7</sub>	M <sub>8</sub>	Mean
S <sub>1</sub>	5999	5495	3855	2819	6306	5772	4037	3021	4663	5726	5125	3710	2665	6069	5555	3886	2860	4449
S <sub>2</sub>	6527	6061	4388	3150	6992	6254	4723	3533	5203	6220	5766	4223	2840	6633	6020	4546	3160	4939
S <sub>3</sub>	6182	5789	4116	2773	6501	5998	4369	3179	4863	6094	5601	4058	2380	6450	5773	4205	2627	4648
Mean	6236	5781	4120	2914	6600	6008	4276	3214		6013	5497	3997	2628	6421	5782	4212	2882	

	SEd	CD	SEd	CD
M	131	281	127	270
S	105	214	101	204
M at S	199	422	194	410
S at M	296	603	281	573

Table 5 : Effect of seed rate, dhaincha intercropping and N management on Harvest Index of hybrid rice

Treatments	Harvest index	
	1999-2000	2000-2001
M <sub>1</sub>	0.45	0.45
M <sub>2</sub>	0.44	0.45
M <sub>3</sub>	0.42	0.42
M <sub>4</sub>	0.39	0.38
M <sub>5</sub>	0.45	0.45
M <sub>6</sub>	0.45	0.45
M <sub>7</sub>	0.43	0.43
M <sub>8</sub>	0.40	0.39
SEd	0.01	0.01
CD (P=0.05)	0.02	0.02
S <sub>1</sub>	0.43	0.43
S <sub>2</sub>	0.43	0.43
S <sub>3</sub>	0.43	0.43
SEd	0.01	0.01
CD (P=0.05)	NS	NS

2000-2001 also. Sole cropping or dhaincha intercropping using the same seed rate of rice did not seem to affect harvest index of hybrid rice. No significant difference in harvest index among the N management practices.

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