

Effect of organic sources and fertilizer levels on morphophysiological characters of flag leaf in hybrid rice (*Oryza sativa L.*)



Agriculture

KEYWORDS : chlorophyll content of flag leaf, Flag leaf angle, Flag leaf length, rice straw, subabul.

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ABSTRACT

Field experiment was conducted during kharif 2009 and 2010 College Farm, College of Agriculture, Rajendranagar, Hyderabad to study the effect of organic sources and fertilizer levels on the flag leaf characteristics of hybrid rice. The experiment was laid in split plot design with three replications. The treatments included organic sources (control – no organic manuring, subabul incorporation @ 5 t ha⁻¹, rice straw incorporation @ 2.5 t ha⁻¹) as main plot treatments and fertilizer levels comprising of N:K₂O kg ha⁻¹ (150:75, 175:50, 175:25, 200:50, 200:25, 225:0) as sub plot treatments. The results revealed that among the organic sources, incorporation of subabul @ 5 t ha⁻¹ recorded the highest flag leaf length, flag leaf angle and chlorophyll content of flag leaf. Fertilizer level comprising 200:50 N:K₂O kg ha⁻¹ was the best among the fertilizer level tested during both the years of study. Interaction effect was found significant on flag leaf length and flag leaf angle. Subabul incorporation @ 5 t ha⁻¹ + 200:50 N:K₂O kg ha⁻¹ recorded the highest flag leaf length and flag leaf angle and was comparable to subabul incorporation @ 5 t ha⁻¹ + 200:25 N:K₂O kg ha⁻¹ in both the years of study.

INTRODUCTION

Rice has a special significance in Asia, where about 90% of the rice is produced and consumed as a staple food. Considering the increasing demand because of population increase on the one hand and decreasing land and water resources available for rice cultivation on the other, it is critical to develop and use rice technologies that will result in higher yields (Virmani and Ish Kumar, 2004). Therefore the development of biologically superior and physiologically efficient genotypes with high yield potential is essentially required. The top three leaves especially flag leaf contributes most to grain yield (Misra, 1986). Flag leaf has an important role in rice yield by increasing grain weight to the tune of 41 to 43 percent. Therefore flag leaf is activist leaf at grain filling period and could be chosen as a factor for increasing the grain yield of rice (Rao, 1997). Mae (1997) reported that there was a positive correlation between flag leaf angle and translocation of photosynthates and spikelet fertility in rice. Research studies related to the influence of nutrient management practices on the flag leaf characteristics of rice is scanty. Therefore an effort was made to study the effect of organic sources and fertilizer levels on the morpho-physiological characters of flag leaf in hybrid rice.

MATERIALS AND METHODS

Field experiment was conducted during kharif 2009 and 2010 at College Farm, College of Agriculture, Rajendranagar, Hyderabad to study the effect of organic sources and fertilizer levels on morpho-physiological characters of flag leaf in hybrid rice. The farm is geographically situated at an altitude of 542.6 m above the mean sea level on 17° 19' N latitude and 78° 23' E longitudes. The soil of the experimental site was sandy clay loam in texture, low in available nitrogen (242 kg ha⁻¹), medium in available phosphorus (39.4 kg ha⁻¹) and high in available potassium (368 kg ha⁻¹). The experiment was laid out in split plot design replicated thrice with organic manures (M₁ - No organic manuring (control), M₂ - Subabul incorporation @ 5 t ha⁻¹, M₃ - Rice straw incorporation @ 2.5 t ha⁻¹) assigned to main plots and six N:K₂O kg ha⁻¹ fertilizer levels (F₁-150:75; F₂-175:50; F₃-175:25; F₄-200:50; F₅-200:25; F₆-225:0) to sub plots. Measured quantities of subabul twigs and rice straw were incorporated in the respective treatment plot twelve days before transplanting. The nutrient content (%) of N:P₂O₅:K₂O in subabul twigs was 3.90:0.39:2.2 and 3.84:0.40:2.3 in 2009 and 2010 respectively while in rice straw N:P₂O₅:K₂O was 0.54:0.16:1.6 and 0.51:0.14:1.5 in 2009 and 2010 respectively. The entire dose of P₂O₅ and half dose of K₂O were applied basally while N was applied in three equal splits *i.e.* at transplanting, maximum tillering and at panicle initiation stage. The remaining K₂O was applied at flowering stage of the crop. 25 and 21 days old seedlings @ one seedling per hill were transplanted during 2009 and 2010

respectively. Spacing of 20x15cm was adopted for transplanting. The hybrid used was KRH-2. Standard cultural practices were practiced until the crop was mature. Five hills (excluding border hills) were randomly selected from each plot at flowering stage for measuring flag leaf length and flag leaf angle. Chlorophyll content of flag leaf was measured using chlorophyll meter (SPAD 502). The data were subjected to statistical analysis by applying analysis of variance for split plot design and significance was tested by F-test (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

Flag leaf length and flag leaf angle

The data presented in Table 1 revealed that the flag leaf length and flag leaf angle of hybrid rice was significantly influenced by organic sources and fertilizer levels. Among the organic sources tested, incorporation of subabul @ 5 t ha⁻¹ recorded the highest flag leaf length and flag leaf angle. The next best treatment was rice straw incorporation @ 2.5 t ha⁻¹. Both the organic sources were found significantly superior to the control treatment. The increase in flag leaf length and flag leaf angle with the application of organic sources might be due to the enhanced availability of nutrients. An increase in flag leaf length of rice with the application of organic sources was also reported by Morteza Siavoshi, Alireza Naziri and Shankar Laware (2011). Among the fertilizer levels tested, 200:50 N:K₂O kg ha⁻¹ was found best in recording higher values of flag leaf length and flag leaf angle during both the years of study. Interaction effect between organic sources and fertilizer levels on flag leaf length and flag leaf length is presented in Tables 2 and 3. Interaction effect was found significant on flag leaf length and flag leaf angle. Subabul incorporation @ 5 t ha⁻¹ + 200:50 N:K₂O kg ha⁻¹ recorded the highest value of flag leaf length and flag leaf angle in both the years of study and remained on par with subabul incorporation @ 5 t ha⁻¹ + 200:25 N:K₂O kg ha⁻¹.

Chlorophyll content of flag leaf

The data on chlorophyll content of flag leaf is presented in Table 1. Subabul incorporation @ 5 t ha⁻¹ recorded the highest flag leaf chlorophyll content in both the years of study. Both the organic sources recorded significantly higher values of flag leaf chlorophyll content when compared to control (no organic manuring). The significantly higher chlorophyll content with incorporation of subabul might be due to the presence of higher nitrogen content. Luu Hong Man, Vu Tien Khang and Takeshi Watanabe (2003) also reported higher SPAD values with rice straw manuring when compared to control. Chlorophyll content of flag leaf was the highest with the application of 200:50 N:K₂O kg ha⁻¹ and was comparable to 200:25 and 225:0 N:K₂O kg ha⁻¹. Higher levels of nitrogen application might be the probable reason for higher values of flag leaf chlorophyll content in F₄, F₅ and F₆.

Table 1 Flag leaf length, Flag leaf angle and flag leaf chlorophyll content of rice as influenced by organic sources and fertilizer levels

Treatment	Flag leaf length (cm)		Flag leaf angle		Flag leaf chlorophyll content (SPAD readings)	
	2009	2010	2009	2010	2009	2010
Organic sources	2009	2010	2009	2010	2009	2010
M ₁ - No organic manuring (control)	25.46	26.46	83.01	84.96	33.22	33.98
M ₂ - Subabul incorporation @ 5 t ha ⁻¹	27.24	28.32	89.65	91.86	35.66	36.09
M ₃ - Rice straw incorporation @ 2.5 t ha ⁻¹	26.13	27.27	85.87	87.89	34.42	34.61
S.Em±	0.18	0.16	0.14	0.15	0.03	0.02
CD (P=0.05)	0.40	0.38	0.29	0.35	0.08	0.05
Fertilizer levels (N:K ₂ O kg ha ⁻¹)						
F ₁ - 150:75	25.35	26.40	83.13	85.12	32.97	33.10
F ₂ - 175:50	26.15	27.26	85.74	87.79	33.88	34.19
F ₃ - 175:25	25.51	26.55	83.67	85.68	33.06	33.28
F ₄ - 200:50	27.38	28.37	89.78	91.92	34.90	35.11
F ₅ - 200:25	26.90	27.98	88.23	90.34	34.88	35.09
F ₆ - 225:0	26.38	27.52	86.51	88.58	34.87	35.07
S.Em±	0.10	0.10	0.11	0.13	0.02	0.03
CD (P=0.05)	0.28	0.26	0.23	0.29	0.05	0.07

Table 2. Effect of organic sources and fertilizer levels on flag leaf length (cm) of hybrid rice

Organic sources	Fertilizer levels (N:K ₂ O kg ha ⁻¹)						Mean
	F ₁ 150:75	F ₂ 175:50	F ₃ 175:25	F ₄ 200:50	F ₅ 200:25	F ₆ 225:0	
M ₁ - No manuring (Control)	25.00	25.85	24.27	26.47	25.73	25.43	25.46
M ₂ - Subabul incorporation @ 5 t ha ⁻¹	25.75	26.74	26.67	28.52	28.22	27.52	27.24
M ₃ - Rice straw incorporation @ 2.5 t ha ⁻¹	25.31	25.86	25.60	27.14	26.76	26.19	26.13
Mean	25.35	26.15	25.51	27.38	26.90	26.38	
	S.Em±		CD (P=0.05)				
F at same level of M	0.15		0.34				
M at same or different level of F	0.44		0.92				

2010							
M ₁ - No manuring (Control)	26.01	26.97	25.22	27.37	26.70	26.48	26.46
M ₂ - Subabul incorporation @ 5 t ha ⁻¹	26.81	27.83	27.66	29.54	29.27	28.80	28.32
M ₃ - Rice straw incorporation @ 2.5 t ha ⁻¹	26.39	26.99	26.76	28.20	27.98	27.29	27.27
Mean	26.40	27.26	26.55	28.37	27.98	27.52	
	S.Em±		CD (P=0.05)				
F at same level of M	0.18		0.40				
M at same or different level of F	0.47		0.95				

Table 3. Effect of organic sources and fertilizer levels on flag leaf angle of hybrid rice

2009							
Organic sources	Fertilizer levels (N:K ₂ O kg ha ⁻¹)						Mean
	F ₁ 150:75	F ₂ 175:50	F ₃ 175:25	F ₄ 200:50	F ₅ 200:25	F ₆ 225:0	
M ₁ - No manuring (Control)	81.50	84.26	79.14	86.30	83.91	82.93	83.01
M ₂ - Subabul incorporation @ 5 t ha ⁻¹	84.76	88.03	87.78	93.87	92.89	90.58	89.65
M ₃ - Rice straw incorporation @ 2.5 t ha ⁻¹	83.13	84.93	84.10	89.16	87.89	86.03	85.87
Mean	83.13	85.74	83.67	89.78	88.23	86.51	
	S.Em±		CD (P=0.05)				
F at same level of M	0.50		1.02				
M at same or different level of F	0.53		1.08				
2010							
M ₁ - No manuring (Control)	83.42	86.25	81.01	88.34	85.88	84.88	84.96
M ₂ - Subabul incorporation @ 5 t ha ⁻¹	86.84	90.20	89.94	96.17	95.18	92.81	91.86
M ₃ - Rice straw incorporation @ 2.5 t ha ⁻¹	85.09	86.92	86.08	91.26	89.96	88.05	87.89
Mean	85.12	87.79	85.68	91.92	90.34	88.58	
	S.Em±		CD (P=0.05)				
F at same level of M	0.55		1.11				
M at same or different level of F	0.61		1.24				

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