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Management of low light effects in late *rabi* season rice

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Abstract : Field experiments were conducted at Agricultural College and Research Institute, Madurai during late *rabi* season of 1997-98 and 1998-99 and the results revealed that foliar spraying of 2 ppm Triacontanol at 35 and 65 DAT significantly increased the LAI, LAD, chlorophyll content and these led to higher grain yield (6346, 6410 kg ha^{-1} during 1997-98 and 1998-99 respectively). This was followed by application of 20 ppm Benzyladenine and Arappu leaf extract.

Keywords: Late rabi rice, Low light, Triacontanol, Benzyladenine, Arappu leaf extract.

Introduction

In Periyar Vaigai Command area of Tamil Nadu, rice is cultivated as a major crop both in the *kharif* and *rabi* seasons. In the event of delayed onset of South West Monsoon (SWM) and subsequent inadequate storage position of water in the reservoirs, the release of water is delayed even upto August and consequently the transplanting of *kharif* rice also gets delayed. This will result in the delayed transplanting of *rabi* rice. Under such late *rabi* situation, the weather is not very conducive to proper growth and development of rice crop. The low temperature and insufficient light that prevailed during this seasons lead to reduced chlorophyll content and photosynthetic rate and low dry matter production (Rao, 1989; Thangaraj and Sivasubramanian, 1990; Krishnakumar and Subramanian, 1991). Keeping this in view, experiments were carried out to study the effect of foliar spray of Triacontanol, Benzyladenine and Arappu leaf extract on late *rabi rice.*

Materials and Methods

Field experiments were conducted during late *rabi* seasons of 1997-98 and 1998-99 at Agricultural College and Research Institute, Madurai. The soil was sandy clay loam in texture, neutral in reaction (pH 7.2); low, medium and high in available N, P and K status respectively. During *rabi* season various weather parameters were recorded. The mean maximum and minimum temperature were 28.8°C and 22.6°C. The relative humidity ranged between 70-87 % during the cropping season. The treatments consisted of No spray (S_1); 5% Arappu leaf *(Albizzia amara)* extract (S_2); 2 ppm Triacontanol (S_3); 20ppm Benzyladenine. The design was randomised block design replicated four times. These foliar sprays were given on 35 & 65 DAT. The medium duration rice cv. ADT-39 was transplanted on 30th November in 1997-98 and 11th November in 1998-99. The recommended dose of 50 kg P_2O_5 ha^{-1} was applied as basal and 150 kg N ha^{-1} and 50 kg K_2O ha^{-1} were applied in four splits *i.e.*, at 7,21, 55 and 65 DAT.

The Leaf Area Index (LAI) was worked out by the formula suggested by Palanisamy and Gomez (1974).

$$LAI = \frac{\text{Total leaf area of the plant (cm}^2\text{)}}{\text{Land area occupied by the plant (cm}^2\text{)}}$$

Leaf Area (LA) = K (L x B) where,
L - length ; B - breadth of the third leaf
K - A constant factor (0.75)

The Leaf Area Duration (LAD) was calculated by the method given by Kvet *et al.* (1971).

$$LAD = \frac{L_1 + L_2}{2 (t_2 - t_1)}$$

Where, L_1 and L_2 are LAI at time t_1 and t_2.

The chlorophyll content was measured by using SPAD-502 metre. The readings were recorded on the upper most fully expanded leaves in five randomly chosen plants at vegetative and flowering stages. The average values were worked out for each plot and expressed as SPAD readings.

Results and Discussion

Foliar spraying of Triacontanol @ 2 ppm at 35 and 65 DAT had recorded significantly

Table 1. Effect of Botanicals and growth regulators on LAI, LAD, Chlorophyll content and grain yield of late rabi rice

Treatments		Leaf area index				Leaf area duration (days)				Chlorophyll Content (SPAD reading)				Grain yield (kg ha^{-1})	
		Vegetative		Flowering		Vegetative		Flowering		Vegetative		Flowering			
		1997-98	1998-99	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99
S_1	No spray	2.75	3.20	5.33	5.51	116	111	121	131	38.7	39.5	36.7	35.8	5324	5513
S_2	5% Arappu leaf extract spray at 35 & 65 DAT	2.95	3.40	5.69	5.90	121	128	130	140	40.2	42.3	38.0	38.3	5701	5897
S_3	2 ppm Triacontanol at 35 & 65 DAT	3.23	3.80	6.25	6.50	136	140	142	155	46.8	46.3	41.6	42.0	6246	6410
S_4	20 ppm BA at 35 & 65 DAT	3.05	3.59	5.88	6.10	128	131	134	146	44.2	43.5	39.2	39.5	5883	6075
	SEd	0.07	0.07	0.21	0.10	1	2	3	4	1.1	1.3	0.9	0.8	53	66
	CD (0.05)	10.13	10.15	10.42	10.21	5	4	7	19	12.3	12.5	1.8	1.6	107	134

increased LAI followed by Benzyladenine as compared to Arappu and no spray treatments. The trend was similar both at different stages and also between years (Table 3).

The LAD ranged between 111 to 140, 121 to 155 days at vegetative and flowering stages during 1997 - 98 and 1998 - 99 respectively. Foliar spraying of botanicals and chemicals had significant effect during both the years of study. Triacontanol sprayed @ 2 ppm recorded significantly higher LAD over no spray and this was followed by Benzyladenine spray.

The possible role played by the foliar spray of botanicals and chemicals was that the growth regulators did accelerate photophosphorylation in the chloroplasts (Chen, 1980). Benzyladenine was found to delay the leaf scenesence by delaying the chlorophyll loss (Daniel *et al.* 1991). Arappu leaf extract, to certain extent helped to mitigate the low light stress when compared to no spray due to the presence of plant hormones in the young leaves. In this regard, convincing evidences had been outlined by Ponnuswamy *et al.* (1996).

Triacontanol and Benzyladenine highly influenced the chlorophyll content and kept the leaves functional for a longer period and thereby maintained high nitrate reductase (NR) during the reproductive phase which supplied N for the synthesis of NR enzyme and thus maintained higher photosynthetic activity in the leaves (Goswami and Srivastava, 1998).

The regulation of scenesence in plant organs by manipulation of light regimes and photosynthesis had been documented by Goldthwaite and Laetsch (1967). The light prevented the scenesence by providing a source of ATP via cyclic phosphorylation. This inturn maintained the synthesis of chlorophyll, protein and nucleic acids in leaves.

Foliar spraying of Triacontanol @ 2 ppm significantly increased the mean rice grain yield by 909 kg ha^{-1} (16.8%) over no spray by registering more number of panicles m^{-2} (403), and filled grains panicle^{-1} (83) for the mean of two years data. This was followed by Benzyladenine and Arappu sprays. The mean of two years grain yield increase was

510 kg ha^{-1} (9.4%) in Benzyladenine and 380 kg ha^{-1} (7.0%) in Arappu spray over the control.

Based on the above results it can be concluded that, for mitigating the effect of low light prevailed during late *rabi* season foliar spraying of Triacontanol @ 2 ppm on 35 and 65 DAT is advocated for getting the higher grain yield.

References

Chen, N.K. (1980). Effect of light and temperature on growth and fertility of rice. *Plant Physiol.* **1:** 15-18.

Daniel, O. Caldis., Jose Bettroano., Laura. V. Fernandez, Santiago, J., Sarandon and Carlos Favorett. (1991). Effect of foliar applied benzyladenine on grain yield and grain protein in wheat. *Plant Growth Regulation.* **10:** 197-204.

Goldthwaite, J.J and Laetcsh, W.M. (1967). Regulation of senescence in bean leaf by light and chemical growth regulators. *Plant Physiol.* **42:** 1757-1762.

Goswami, B.K. and Srivastava, G.C. (1988). Effect of Benzyladenine on protease and related N fixation in sunflower. *Indian J. Plant Physiol.* **31:** 281-284.

Krishnakumar, V. and Subramanian, S. (1991). Influence of meteorological parameters on growth and yield of low land rice. *Oryza.* **28:** 49-54.

Kvet, J., Ondok, J.P., Necas, J. and Jarvis, P.G. (1971). Methods of growth analysis. In : Plant photosynthetic production. A manual of methods Seslak, Z., Catsky, J. and Jarvis, P.G. pp. 343-391. N.V. Publishes, The Hague.

Palanisamy, K.M. and Gomez, K.A. (1974). Length and width method for estimating leaf area for rice. *Agron. J.* **66:** 430-433.

Ponnuswamy, A.S., Rangasamy, M., Rangasamy, P. and Thiyagarajan, K. (1996). Identification of alternative to GA3 in hybrid rice seed production In: Role of croop physiology in improving agricultural productivity. New Vistas for Plant Physiological Research p63. Tamil Nadu Agricultural University, Coimbatore, India.

Rao, A.Y. (1989). Effect of temperature and solar radiation on dry matter accumulation and grain yield in certain low land rice varieties. *Oryza.* **26:** 64-70.

Thangaraj, M. and Sivasubramanian, V. (1990). Effect of low light intensity on growth and productivity of irrigated rice grown in Cauvery delta region. *Madras Agric. J.* **77:** 220-224.

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