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Foliar application of TNAU rice reap for high temperature stress in rice

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Abstract
Temperature above 33°C has led to the production decrement of rice. The temperature optimum shifts to relatively lower temperatures as rice grows. Spikelet sterility is greatly increased at temperatures higher than 35^0C which is the critical maximum temperature in rice. With the growing impact of climate change, optimizing rice cultivation environments has become a critical strategy to ensure stable and increased yields. As a boon to the rice farmers of Tamil Nadu, a crop booster was developed by Department of Crop Physiology, Tamil Nadu Agricultural University named TNAU Rice Reap to improve the spikelet fertility under high temperature stress. This booster reported to Improve the spikelet fertility and grain filling percentage. Further it Improves tolerance against drought and high temperature stress and Increases grain yield up to 15%. Dose is 2 kg / acre, Spray Volume is 200 litres/acre, Stages of spray are at Booting stage (2 kg/acre) and 10 days after first spray (2 kg/acre). Average Yield obtained was 5093 kg/ha in control that is non applied plot and 5580 kg/ha in TNAU rice Reap applied treatment plots. Yield improvement was 487 kg/ha and has recorded 9.5% increase over control. Gross return and Net return (Rs. 1,28,340 and Rs.56,920)was higher with TNAU Rice Reap applied plots over control however the benefit cost ratio was same as the application cost and cost of rice reap was higher than the additional yield and returns obtained. This can be promoted on a large scale for surpassing the high temperature stress in rice.

Keywords: TNAU rice reap, high temperature stress in rice, 9.5% higher yield and returns

Introduction
Rice, an important crop worldwide, supports about half of the global population for their dietary requirements with 782 million tons of annual grain production being cultivated in 167 million hectares of area among 118 countries. Temperature above 33°C has led to the production decrement of rice. The optimal temperature for ripening is lower than that for tillering and anthesis. The temperature optimum shifts to relatively lower temperatures as rice grows. The panicle weight is known to decrease under high temperature (Newman *et al*., 2001; Oh-e *et al*., 2007; Ziska *et al*., 1996) [, 2, 4]. Kim *et al*. (1996) [3] reported that the rate of increase in dry matter in the panicle after the heading decreased under high temperature. This could be partly due to the increase in the number of sterile spikelets. The dry weight of panicle will not recover and the assimilation products will accumulate in leaves and culms, even if prevailing condition occurs.
Spikelet sterility is greatly increased at temperatures higher than 35^0C which is the critical maximum temperature in rice. The results indicate that as temperatures increase, the developmental rate of rice significantly accelerates across all growth stages. Within the temperature threshold range of 18-35 °C, the optimal temperature for maximum growth speed and the shortest overall developmental cycle across all growth stages was identified as 28-32 °C. With the growing impact of climate change, optimizing rice cultivation environments has become a critical strategy to ensure stable and increased yields
As a boon to the rice farmers of Tamil Nadu, a crop booster was developed by Department of Crop Physiology, Tamil Nadu Agricultural Univeristy named TNAU Rice Reap to improve the spikelet fertility under high temperature stress. This booster reported to Improve the spikelet fertility and grain filling percentage. Further it Improves tolerance against drought and high temperature stress and Increases grain yield up to 15%. Dose is 2 kg / acre, Spray Volume is

200 litres/acre, Stages of spray are at Booting stage (2 kg/acre) and 10 days after first spray (2 kg/acre). Cost of the booster is Rs. 484/2 kg available through online marketing of TNAU namely www. tnauagricart.com

Materials and Methods

10 rice fields each 1 acre was identified in Boothangudi, Veyyalur and Vazhakollai villages of Keerapalayam block of Cuddalore district for conducting demonstration on TNAU rice reap in rice. The research was conducted during "Kuruvai"June'2024 and the variety is ASD 16. Rice reap, a product of Tamil Nadu Agricultural University were evaluated in ten identified farmers' field. The product was applied at the rate of 2 kg/acre during the booting stage and 10 days later (2 kg/acre) to surpass the affect of high temperature in rice. Yield and benefit cost ratio was worked out and the result is interpreted

Results and Discussion

TNAU Rice Reap, a product of Tamil Nadu Agricultural University were evaluated in ten identified farmers' field. The product was applied at the rate of 2 kg/acre during the booting stage and 10 days later (2 kg/acre) to surpass the affect of high temperature in rice.

Table 1: Yield(kg/ha) obtained in TNAU rice reap applied plot and control

Demonstration	Yield in control plot (kg/ha)	Yield in TNAU rice reap applied plot (kg/ha)	Additional yield obtained (kg/ha)
1.	5000	5750	750
2.	4900	5560	660
3.	5000	5625	625
4.	5200	5450	250
5.	5150	5720	570
6.	5250	5723	503
7.	5000	5743	743
8.	5150	5425	275
9.	5200	5358	188
10.	5110	5453	343
Mean	5093	5580	487

Average Yield obtained was 5093 kg/ha in control that is non applied plot and 5580 kg/ha in TNAU rice Reap applied treatment plots. Yield improvement was 487 kg/ha and has recorded 9.5% increase over control.

Table 2: Yield and Economics of TNAU Rice Reap applied and non - applied (Control)

	Yield	Gross return (Rs./ha)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	B:C
Control	5093	1,17,139	65000	52,139	1.80
TNAU Rice Reap Applied	5580	1,28,340	71420	56,920	1.80

Gross return and Net return (Rs. 1,28,340 and Rs.56,920)was higher with TNAU Rice Reap applied plots over control however the benefit cost ratio was same as the application cost and cost of rice reap was higher than the additional yield and returns obtained.

This TNAU rice reap can be applied in large scale for higher productivity under climate change especially increased temperature during rice cultivation in Tamil Nadu and may be evaluated in Southern States for the benefit of the Farming community.

Table 1: Effect of IBA concentration and time of planting on days taken to root emergence in *Cupressus macrocarpa*.

IBA concentration (ppm)	Days taken to root emergence		
	I st week of July	I st week of August	I st week of September
Distilled water	35.33	37.00	38.67
IBA (1500ppm)	31.67	35.67	36.67
IBA (3000ppm)	30.67	33.33	34.67
IBA (4500ppm)	27.33	28.67	30.67
Mean	31.25	33.67	35.17
CD(p≤ 0.05) IBA (I)	1.515		
Time of planting (T)	1.254		
Interaction(IxT)	2.769		

Table 2: Effect of IBA concentration and time of planting on number of primary adventitious roots, number of secondary adventitious roots, length of primary root per cutting and root volume in *Cupressus macrocarpa*.

IBA concentration (ppm)	Number of primary adventitious roots			Number of secondary adventitious roots			Length of primary root per cutting (cm)			Root Volume (ml)		
	I st week of July	I st week of August	I st week of September	I st week of July	I st week of August	I st week of September	I st week of July	I st week of August	I st week of September	I st week of July	I st week of August	I st week of September
Distilled water	0.67	0.33	0.33	1.00	0.67	0.33	2.20	1.86	1.62	1.60	1.50	1.03
IBA(1500ppm)	3.33	2.33	1.33	12.00	8.67	7.33	5.67	4.86	4.08	2.82	2.04	1.45
IBA(3000ppm)	5.67	4.33	2.67	16.33	12.33	10.67	6.28	5.44	5.22	3.07	2.87	2.62
IBA(4500ppm)	6.33	4.67	3.33	22.33	20.67	19.33	7.29	6.03	5.72	3.67	3.15	2.90
Mean	4.00	2.92	1.92	12.92	10.58	9.42	5.37	4.55	4.15	2.79	2.39	2.00
CD(p≤0.05) IBA (I)	0.952			0.86			0.29			0.190		
Time of planting (T)	0.613			0.75			0.23			0.160		
Interaction (IxT)	1.565			1.49			0.47			0.350		

Table 3: Effect of IBA concentration and time of planting on collar diameter, length of cutting and percent cuttings rooted, in *Cupressus macrocarpa*.

IBA concentration (ppm)	Collar diameter (mm)			Length of cutting (cm)			Percentage cuttings rooted			Survival of rooted cuttings (%)		
	Ist week of July	Ist week of August	Istweek of September	Ist week of July	Ist week of August	Ist week of September	Ist week of July	Ist week of August	Istweek of September	Ist week of July	Ist week of August	Ist week of September
Distilled water	1.36	1.27	1.15	19.32	19.21	18.97	24.97	22.03	20.64	22.14	20.68	19.68
IBA(1500ppm)	1.53	1.45	1.36	20.10	19.92	19.66	28.87	27.36	26.44	57.97	53.31	50.24
IBA(3000ppm)	1.47	1.39	1.27	20.64	20.41	20.12	57.16	52.24	49.14	63.11	57.62	53.05
IBA(4500ppm)	1.63	1.51	1.46	22.14	21.84	21.39	70.71	65.49	56.73	75.68	67.97	59.93
Mean	1.50	1.40	1.31	20.55	20.35	20.03	45.43	41.78	38.24	54.73	49.80	45.73
CD(p≤0.05) IBA (I)	0.044			0.171			0.044			0.686		
Time of planting (T)	0.038			0.148			0.038			0.594		
Interaction (IxT)	0.082			0.319			0.077			1.188		

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