Journal of Crop and Weed, 5(2): 128-130 (2009)

Efficacy of *Triacontanol* on the growth and yield of rice crop in inceptisol of West Bengal

D. PAL, S. MALLICK, R. K. GHOSH, P. PAL, L. TZUDIR AND K. BARUI

Department of Agronomy, Faculty of Agriculture,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, WB

ABSTRACT

A field experiment was conducted for two consecutive years to study the growth and yield response of rice during kharif season under different levels of triacontanol. Application of triacontanol in rice (cv. Satabdi) indicated that the crop stand was satisfactory and no significant difference was observed in plant number per unit area. Increase in yield of crop over control was found to be to the tune of 24.94 q/ha grain yield with triacontanol 95 percent @ 0.33 ml per liter of water with an increase of 51.26 percent grain yield and 47.13percent straw yield.. Application of triacontanol showed positive effect on Leaf Area Index and dry matter accumulation of the crop.

Key words: Efficacy, rice, triacontanol and yield.

Rice is an important cereal crop in developing countries and also the staple food for over half of the world's population, ranking second to wheat in terms of area and production (Nandi *et.al,* 1990). Out of total production in world, maximum *i.e.* 91% is produced and consumed in Asia region. The area under rice cultivation in world is 150.76 million hectare producing 562.26 million tones of rice with a productivity of 3.7 t/ha (Mallick, 2008). While the food demand of the country is increasing day by day due to rapid population growth, the total cultivable area on the contrary is decreasing. To bridge the gap between these two and to meet up the need for food, one of the avenues is to use plant growth regulators to produce major changes in growth *vis-a-vis* productivity.

Triacontanol was a plant growth regulator found in the plant cuticle waxes and in bee wax as the palmitate ester. Triacontanol have growth enhancing properties when applied to the leaves of growing plants. It is also known as melissyl alcohol and myricyl alcohol. It is a totally nontoxic, plant growth bio-regulator without any residual effect (Samui and Roy, 2007). It produces stronger seedlings with better root system and finally developed into vigorous plants which produces better yield (Ahmed, 1990; De and Haquue, 1996). In spite of the above characters of the plant growth regulators, farmers still use these substances in a very limited scale. Thus, in this study an attemed has been taken to study (i) the response of triacontanol on growth, yield of grain and straw of rice under West Bengal condition.

MATERIALS AND METHODS

A field experiment was conducted at "C" Block Farm of Bidhan Chandra Krishi Viswavidyalaya Kalyani, Nadia, West Bengal on inceptisol *i.e.* Gangetic alluvial with sandy loam in texture soil with rice variety Satabdi in *kharif* season.The experiment was laid out in RBD having seven treatments viz., T_1: Untreated control, T_2: Triacontanol 95% @ 1ml per lit^{-1} of water, T_3: Triacontanol 95% @ 0.5ml lit^{-1} of water, T_4: Triacontanol 95% @ 0.33 ml $lit^{-1}$of water, T_5: Triacontanol 0.1% @ 0.5 ml lit^{-1} of water, T_6: Triacontanol 0.05% @ 1ml $lit^{-1}$of water, T_7: Nitrobenzene 20% @ 2.5 ml lit^{-1} of water. Each treatment replicated thrice. In this experiment three standards of triacontanol based growth regulator were used namely such as phytonol, vipul and miraculan along with nitrobenzene based growth regulator. Spraying of the chemicals was done thrice at 30 days after transplanting (DAT), 45DAT and 60DAT with knapsack sprayer. Recommended dose of fertilizer @ 60: 30:30 (NPK) kg ha^{-1} was applied on the transplanted rice crop in splits judiciously *i.e*. 50% N, full P_2O_5 and 75% K_2O as basal, rest nitrogen as top dressing at 25 DAT and 45 DAT and rest K_2O at 25 DAT.

RESULTS AND DISCUSSION

Leaf area index

LAI at 40, 55 and 70 DAT are shown in Table-1, which revealed that highest LAI value was recorded in (T_4) triacontanol 95% @ 0.33 ml/lit of water whereas lowest value was obtained with the untreated control. Treatment with nitrobenzene 20% (T_7) @ 2.5 ml/lit of water recorded next highest value in all the stages. Treatments (T_3) triacontanol 95% @ 0.5 ml/lit of water and (T_6) triacontanol @ 0.05% @ 1ml/lit of water also recorded promising results. Rest treatments were also superior to control plot (T_1) though they recorded lower value of LAI in comparison to the above mentioned treatments.

E-mail : paldebesh@rediffmail.com.

Crop growth rate

Crop growth rate (CGR) of rice crop in different treatments was taken at 40-55 DAT and also at 55-70 DAT which are presented in Table-1.At 40-55 DAT, the highest CGR value (9.84 g .m^{-2} day^{-1}) was recorded in the treatment T_4 (Triacontanol 95% @ 0.33 ml per lit of water) and lowest value recorded in control (T_1). All other treatments (T_2, T_3, T_5 and T_6) produced significantly higher value of CGR than control plot treatment).At 55-70 DAT, the highest CGR value (7.12 g. m^{-2} day^{-1}) was obtained in treatment triacontanol 95% @ 0.5 ml/lit of water (T_3). Treatments T_1 (control) and T_7 (Nitrobenzene 20% @ 2.5 ml/lit of water) were statistically *at par* which showed the lowest value. It is also clear from the results that there was a consistency of the treatments in performance between the two stages.

Yield components

The yield attributing characters which influenced the yield of crop were presented in table 2. Highest panicle length at harvesting (25.19 cm) was obtained with treatment triacontanol 95% @ 0.5 ml/lit of water (T_3). Treatments T_4 (triacontanol 95% @ 0.33 ml/lit of water, T_5 (triacontanol 0.1% @ 0.5 ml/lit of water and T_6 (triacontanol 0. 5% @ 1ml/lit of water) were also promising in this respect. Maximum test weight (19.63g) of grain was obtained in T_4 (triacontanol 95% @ 0.33 ml/lit of water) treatment. Application of triacontanol however had no significant effect on the test weight of grain. With respect to different doses of triacontanol had positive influence on number of filled grain/panicle.

Grain yield

Positive influence on the yield attributing characters of the crop reflected significant result in the yield of rice crop (Table 2).Maximum grain yield (24.94 q/ha) was obtained with treatment T_4 (triacontanol 95% @ 0.33 ml/lit. of water. Control plot (T_1) gave the minimum yield and statistically *at par* with T_7 (nitrobenzene 20% @ 2.5 ml /lit of water). Treatment T_3 (triacontanol 95% @ 0.5 ml/lit of water) recorded next highest yield of grain (24.23 q/ha). Treatment T_2 (triacontanol 95% @ 1ml/lit of water) was also promising and produced higher grain yield. Similar result was also recorded by Ravi *et al.* (2007), when phytohormones (triacontanol) and nutrients were sprayed on the transplanted rice. Beneficial effect of triacontanol products on yield attributing characters and yield were also found by several scientists (Vaiyapuri and Sriramachandra, 2003, Pandey, *et al.,* 2001, Bana *et al.,* 1996, Paraye *et al.,* 1995, Datta, 1996, Kawashima *et al.*, 1989).

Straw yield

Similar trend was also obtained in case of straw yield of rice crop; T_4 (triacontanol 95% @ 0.33 ml/lit of water) recorded highest straw yield (32.16 q ha^{-1}) coupled with better growth parameters obtained in the treatment. Treatment T_3 (triacontanol 95% @ 0.5 ml/lit of water) was found to result next higher yield of straw (31.42 q ha^{-1}) and was statistically *at par* with T_2 treatment (triacontanol 95% @ 1.0 ml/lit of water). These two treatments (T_2 and T_3) also obtained also significant higher yield than the rest treatments. The control treatment (T_1) was statistically *at par* with treatment T_7 (nitrobenzene 20% @ 2.5 ml/lit of water which proved inefficient in comparison to the above promising treatments.

Harvest index

In table-2, maximum harvest index (43.67) was observed in T_4 treatment (triacontanol 95% @ 0.33 ml/lit of water) and lowest value was obtained with control treated plot (T_1). However, the treatments T_2 (triacontanol 95% 1ml/lit of water), T_3 (triacontanol 95% @ 0.5 ml/lit of water) and T_6 (triacontanol 0.05% @ 1 ml/lit of water were statistically *at par* with best treatment T_4 (triacontanol 95% @ 0.33 ml/lit of water. In the above promising treatments (*i.e.* T_2, T_3, T_4 and T_6) had some added advantage in increasing the harvest index value. Rest two treatments showed no remarkable performance in this respect.

It is clear from the experimental results that application of triacontanol has positive and significant effects on the growth and yield of rice crop. Best result was obtained with triacontanol 95% @ 0.33 ml/lit of water which increased the grain yield (51.26%) and straw yield (47.13%) over control treatment. So, emphasize should be given for the proper use of triacontanl as plant growth regulator which is advantageous for increasing the growth as well as yield of crop.

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Table 1: Effect of triacontanol on leaf area index and crop growth rate of rice (pooled data)

	Treatments	LAI			CGR (g m^{-2} day^{-1})	
		40DAT	55DAT	70DAT	40-55 DAT	55-70 DAT
T_1	Untreated control	2.21	3.05	2.87	7.71	5.55
T_2	Triacontanol 95% @ 1ml/lit of water	2.29	3.17	2.98	9.74	7.03
T_3	Triacontanol 95% @ 0.5ml/lit of water	2.41	3.22	3.16	9.78	7.12
T_4	Triacontanol 95% @ 0.33ml/lit of water	2.66	3.51	3.32	9.84	7.00
T_5	Triacontanol 0.1% @ 0.5ml/lit of water	2.32	3.16	3.01	8.86	6.56
T_6	Triacontanol 0.05% @ 1ml/lit of water	2.42	3.21	3.18	9.24	6.69
T_7	Nitro benzene 20% @ 2.5ml/lit of water	2.46	3.31	3.21	7.98	5.71
	SEm (±)	**0.044**	**0.046**	**0.033**	**0.135**	**0.127**
	LSD (0.05)	**0.136**	**0.141**	**0.101**	**0.473**	**0.391**

Table 2: Effect of treatments on yield components and yield of rice (Mean data)

	Treatments	Panicle length (cm)	Test weight (g)	Filled grain/ Panicle	Grain yield (qha $^{-1}$)	Straw yield (qha $^{-1}$)	Harvest index (%)
T_1	Untreated control	21.82	18.38	97.54	16.49	21.86	42.73
T_2	Triacontanol 95% @ 1ml/lit of water	22.70	18.64	124.23	23.63	30.70	43.49
T_3	Triacontanol 95% @ 0.5ml/lit of water	25.19	18.95	127.73	24.23	31.42	43.53
T_4	Triacontanol 95% @ 0.33ml/lit of water	23.45	19.63	142.53	24.94	32.16	43.67
T_5	Triacontanol 0.1% @ 0.5ml/lit of water	24.18	18.57	120.37	19.94	26.40	43.03
T_6	Triacontanol 0.05% @ 1ml/lit of water	23.77	18.66	117.17	21.85	28.41	43.47
T_7	Nitro benzene 20% @ 2.5ml/lit of water	22.59	18.54	103.66	16.55	22.18	42.99
	SEm (±)	**0.305**	**0.151**	**2.871**	**0.220**	**0.238**	**0.199**
	LSD (0.05)	**0941**	**NS**	**8.847**	**0.677**	**0.733**	**0.615**