Effect of triacontanol on the growth and yield of potato

S. MALLICK, R. K. GHOSH AND D. PAL

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

Since the green revolution, which showed a dramatic increase in the yields of wheat and rice in the late sixties, the country seems to have reached a threshold in terms of yield and production of these two staple food crops of the country, while the food demands of the country are growing day by day. In the coming decades, third world will experience the most dramatic increase in demand for human food. This will be due to rapid population growth. The crop other than cereals, which has potentiality to overcome the shortage of food as supplemental food for ever increasing population of our country is potato (*Solanun tuberosum* L.), which was introduced in India in the early of 17^{th} century by the Porotugse. A short duration crop like potato, which produces more dry matter (Khuranas, 2006), edible protein per unit land and time than many other major crops such as wheat, rice and maize is the most potential and nutritionally superior crop for fighting hunger and malnutrition. Potato is a rich source of starch, vitamins, especially C and B_1, and minerals. It contains 20.6% carbohydrate, 2.1% protein, 0.3% fat, 1.1% crude fibre and 0.9% ash. The major potato producing countries in the world are Russia, Poland, India, and China. In India it is cultivated in a large scale in U.P., West Bengal, Gujrat, Bihar, and Punjab.

Triacontanol is a plant growth regulator found in the plant cuticle waxes and in beeswax as the palmitate ester. Triacontanol has been reported to have growth enhancing properties when applied to the leaves of growing plants. Triacontanol is a straight-chain C_{30} primary alcohol. Also known as melissyl alcohol and myricyl alcohol, it occurs naturally as its palmitate ester in plant cuticle waxes and beeswax. Its lab synthesis was first reported in 1934. Its only commercial use is as a plant growth regulator, and it has been widely patented for this use. It is a totally non toxic, plant growth bio-regulator without any residual effect. It produces stronger seedlings with better root system and finally develop vigorous plants which produce better yield. In spite of the fact that plant growth regulators modify the physiological processes, growth and may increase the yield of crops, these are used by the farmers on very limited scale. The main limitation is that the chemical is effective only at specific concentration. Similarly the right stage of application of growth regulators is also very important for getting the beneficial effect of these chemicals. Thus, the optimum concentration and right stage of stage of the crop for application of these growth regulators to get the desired results are essential. In this experiment, an attempt has been made to study the growth response and yield of potato under different levels of triacontanol.

The field experiment was conducted during *rabi* season 2007-08 with potato crop at Kalyani 'C' Block Farm, BCKV, Nadia, West Bengal. The Farm is situated at 22^0 57/ N latitude and $88^0$20/ E longitude with an altitude of 9.75 m above MSL. The soil is typical Gangetic alluvial (*i.e.,* inceptisol), sandy loam in texture, pH - 6.8, organic carbone - 0.568%, Total nitrogen - 0.0568%, available phosphorus - 18.6 Kg ha^{-1}, and available potassium - 124.9 Kg ha^{-1} . There were 7 treatments, which were allocated under Randomized Block Design (RBD) with three replications, viz., T_1 – Untreated control, T_2 – Triacontanol 95%@ 1 ml 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% @ 1 ml lit^{-1} of water, T_7 – Nitro benzene 20% @ 2.5 ml lit^{-1} of water. Sprayings were done thrice with a knapsack sprayer at 30 DAP, 45 DAP and 60 DAP. Potato tubers of 'Kufri Jyoti' were planted in ridge method after treating with Indofil – M-45 @ 100g/100 lit water per 120kg cut tubers for 5 minutes.

Leaf Area Index (LAI) of the potato crop continued to increase up to sparsely stages of crop growth and there after began to fall at a slower rate (Table 1). Data at 40 DAP showed that the maximum LAI (1.66) was recorded in the treatment T_4 (Triacontanol 95% @ 0.33 ml/lit of water) followed by treatment T_7 (Nitro benzene 20% @ 2.5ml/lit of water) – (1.58) statistically at par at all the stages. The T_3 (Triacontanol 95% @ 0.5ml/lit of water) produced significantly higher LAI value over control as well as over rest of the treatments. This trend was observed at other two stages *i.e.* at 55 DAP and 70 DAP. Treatment T_2 (Triacontanol 95% @ 1 ml/lit of water), T_5 (Triacontanol 0.1% @ 0.5ml/ lit of water) and T_6 (Triacontanol 0.05% @ 1ml/ lit of water) did not show the remarkable increase in LAI.

Treatment T_4 (Triacontanol 95% @ 0.33 ml/lit of water) gave the highest dry matter in comparison to other treatments at all the stages of the crop growth. Lowest value was obtained from the

E-mail: subha_papai@rediffmail.com
Short communication

untreated control plot (T_1) at all stages. Other treatments failed to result remarkable change. Among the other treatments, only T_6 (Triacontanol 0.05% @ 1ml/ lit of water) showed to some consistency in results at all the stages.

Table 1 : Effect of treatments on LAI and dry matter production of potato

Treatments	Treatment details	LAI			Dry matter production ($g\ m^{-2}$)		
		40DAP	55DAP	70DAP	40DAP	55DAP	70DAP
T_1	Untreated control	1.00	1.61	1.62	130.22	261.56	395.81
T_2	Triacontanol 95% @ 1ml/lit of water	1.15	1.96	1.77	161.20	346.67	487.39
T_3	Triacontanol 95% @ 0.5ml/lit of water	1.49	2.00	1.95	175.95	346.25	529.87
T_4	Triacontanol 95% @ 0.33ml/lit of water	1.66	2.38	2.15	183.43	363.45	553.28
T_5	Triacontanol 0.1% @ 0.5ml/lit of water	1.37	1.93	1.78	162.30	347.64	516.64
T_6	Triacontanol 0.05% @ 1ml/lit of water	1.25	1.89	1.67	174.81	350.11	531.91
T_7	Nitro benzene 20% @ 2.5ml/lit of water	1.58	2.37	2.16	162.25	344.15	487.54
	SEm (±)	**0.037**	**0.086**	**0.060**	**3.340**	**4.184**	**6.882**
	LSD(0.05)	**0.115**	**0.265**	**0.186**	**10.292**	**12.891**	**21.205**

Crop Growth Rate (CGR) was calculated at 40-55 DAP and 55-70 DAP (Table 2).At 40-55 DAP the highest CGR value (12.36 g m^{-2} day^{-1}) was recorded in the treatment T_5 (Triacontanol 0.1% @ 0.5ml/ lit of water) and the lowest value recorded in the control (T_1) treatment (8.756 g m^{-2} day^{-1}). All the other treatments (T_2, T_3, T_4, T_6, and T_7) produced significantly higher CGR value than control. At 55-70 DAP the highest CGR value (12.66 g m^{-2} day^{-1}) was obtained in Triacontanol 95% @ 0.33 ml/lit of water (T_4) and the lowest value (8.96 g m^{-2} day^{-1}) was obtained in the control plot (T_1). There was no significant difference among the treatments T_2 (Triacontanol 95% @ 1 ml/lit of water), T_7 (Nitro benzene 20% @ 2.5ml/lit of water) and control (T_1) at this stage. There was no consistency of the treatments in the performance of results between two stages.

Table 2 : Effect of treatments on crop growth rate and tuber bulking rate of potato

Treatments	Treatment details	CGR ($g\ m^{-2}\ day^{-1}$)		Tuber bulking rate ($g\ m^{-2}\ day^{-1}$)		
		40-55 DAP	55-70 DAP	45-60 DAP	60-75 DAP	75-90 DAP
T_1	Untreated control	8.76	8.96	6.91	8.47	6.65
T_2	Triacontanol 95% @ 1ml/lit of water	12.36	9.38	8.25	12.91	7.83
T_3	Triacontanol 95% @ 0.5ml/lit of water	11.35	12.24	9.69	13.78	7.93
T_4	Triacontanol 95% @ 0.33ml/lit of water	12.00	12.66	10.36	14.23	8.32
T_5	Triacontanol 0.1% @ 0.5ml/lit of water	12.37	11.27	8.43	13.21	7.24
T_6	Triacontanol 0.05% @ 1ml/lit of water	11.69	12.12	9.87	12.82	7.96
T_7	Nitro benzene 20% @ 2.5ml/lit of water	12.13	9.56	7.86	12.17	7.28
	SEm (±)	**0.354**	**0.578**	**0.345**	**0.583**	**0.397**
	LSD(0.05)	**1.090**	**1.782**	**1.063**	**1.796**	**1.222**

Tuber bulking rate of potato crop was increased up to 75 DAP there after it decreased (Table 2). Untreated control plot (T_1) recorded significantly lower tuber bulking rate than other treatments at first stage of crop growth except T_6 treatment. T_4 treatment (Triacontanol 95% @ 0.33 ml/lit of water) showed significantly higher TBR (10.36 g m^{-2} day^{-1}) at 45-60 Dap and it was statistically at par with T_3 (9.69 g m^{-2} day^{-1}) and T6 (9.87 g m^{-2} day^{-1}) treatments. Highest values (14.23 g m^{-2} day^{-1}) on tuber bulking rate was at 60-75 DAP in comparison to the other stage. In this stage, T_4 (Triacontanol 95% @ 0.33 ml/lit of water) was closely followed by T_2 (12.91 g m^{-2} day^{-1}), T_3 (13.78 g m^{-2} day^{-1}), T_5 (13.21 g m^{-2} day^{-1}) and T_6 (12.17 g m^{-2} day^{-1}). All the plots treated with growth stimulant gave significantly higher tuber bulking rate than the control plot (T_1) which recorded the lowest value (8.47 g m^{-2} day^{-1}). During 75-90 DAP, the tuber bulking rate again decreased. It recorded lowest value (6.65 g m^{-2} day^{-1}) and highest value (8.32 g m^{-2} day^{-1}) in treatments T_1 (conrol) and T_4 (Triacontanol 95% @ 0.33 ml/lit of water) respectively. Other treatments produced higher tuber bulking rate than control except T_2 (Triacontanol 95% @ 1 ml/lit of water), T_5 (Triacontanol 0.1% @ 0.5ml/ lit of water) and T_7 (Nitro benzene 20% @ 2.5ml/lit of water). It is also cleare from the data that there was no consistency

among the treatments in their effects at these stages except T_4 and to some extent T_3 treatment.

The data on tuber yield of potato are presented in the table 3. It is seen that tuber yield of potato was highest (23.24 t ha^{-1}) in treatment T_4 (Triacontanol 95% @ 0.33 ml/lit of water) which was significantly higher than all other treatments. Treatment T_3 (Triacontanol 95% @ 0.5ml/lit of water) gave next highest yield (22.27 t ha^{-1}) which was at par with the treatments T_2 (Triacontanol 95% @ 1 ml/lit of water), T_5 (Triacontanol 0.1% @ 0.5ml/ lit of water) and (Triacontanol 0.05% @ 1ml/ lit of water). The treatment T_7 (Nitro benzene 20% @ 2.5ml/lit of water) was not so promising in comparison to other chemical treated plot but it was still superior to control. Samui and Roy (2007) from a field experiment during 2002-03 at farmers field Surekalna, WB on potato found that application of Miraculan 0.25 g a.i./ha and Vipul 0.5 g a.i./ha improve the productivity of the potato crop.

Liu-Hua *et al.* (2002) found from a field experiment with potato at Shanxi, China that foliar applications of Triacontanol (0.1% EC) at different concentrations (0.2 x 10-6, 0.5 x 10-6, 0.8 x 10-6 and 1.0 x 10-6 g/lit) at flower bud appearance stage (FBAS) or flowering stage (FS) resulted and increase in tuber yield and number of large tubers and starch content.

Table 3 : Effect of treatments on yield of potato

Treatments	Treatment details	Tuber yield of potato (t ha^{-1})
T_1	Untreated control	19.41
T_2	Triacontanol 95% @ 1ml/lit of water	21.86
T_3	Triacontanol 95% @ 0.5ml/lit of water	22.07
T_4	Triacontanol 95% @ 0.33ml/lit of water	23.24
T_5	Triacontanol 0.1% @ 0.5ml/lit of water	21.98
T_6	Triacontanol 0.05% @ 1ml/lit of water	21.93
T_7	Nitro benzene 20% @ 2.5ml/lit of water	20.67
	SEm (±)	**0.365**
	LSD(0.05)	**1.124**

It may be concluded from the results that the application of Triacontanol is advantageous for increasing the growth and yield of potato crop.

REFERENCES

Liu Hua, Feng Gao, Liu H, Feng G 2002 . Studies on yield-increasing effects of foliar application of triacontanol solution on potato. *Chinese Potato J.* **16**: 83

Khuranas, M. Paul. 2006 . Indian potato exports an overview. *Potato J.*. **33**:1-10

Samui, R. C. and Roy, A. 2007 . Effect of growth regulators on growth yield and natural enemies of potato. *J. Crop Weed.* **3**:47-49