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EFFECTS OF TIBA ON GROWTH, YIELD AND YIELD COMPONENTS OF SOYBEAN

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Abstract

Effects of 20, 50, 100 and 150 ppm TIBA on growth and yield of BARI soybean -5 were evaluated. Plant height reduced significantly due to 50, 100 and 150 ppm TIBA. There was an increasing tendency in number of leaves per plant with increase in the concentrations of TIBA. Number of leaves and dry weight of shoot significantly increased following TIBA applications. Yield components *viz*. number of branches per plant, number of pods per plant, fresh weight and dry weight of pods per plant, 100 seed weight and seed yield per plant increased significantly due to 100 and 150 ppm TIBA application, whereas, most of the yield parameters decreased due to 20 ppm TIBA. Yield per plant increased by 7.32, 18.81 and 21.50% following 50, 100 and 150 ppm TIBA. Pigment content of leaf was not affected significantly due to TIBA application. Amongst all the concentrations 150 ppm TIBA produced best stimulation.

Key words: Soybean, TIBA, Growth, Yield components, Yield

Introduction

The production of oilseeds is very low in Bangladesh and there is an increasing demand of oilseeds. Soybean, *Glycine max* (L.) Merrill, has a good prospect among the important oil yielding crops of Bangladesh and also an excellent source of protein. The prospect of soybean cultivation is good in Bangladesh. It can be cultivated throughout the year (Khaleque and Siddique 1982). It also improves soil fertility by fixing atmospheric N_2. Bangladesh has to depend upon other countries for the supply of soybean oil. According to Department of Agricultural Extension (DAE), Bangladesh could meet 40 percent of the soybean oil demand by producing soybean locally. So, the productivity of oilseeds has to be increased.

Tri-iodo benzoic acid (TIBA), although a growth retardant, in low concentrations has been found to increase the yield of different crop plants. Investigations in other countries had showed that application of TIBA induced greater growth and yield of soybean (Chung and Kim 1989 and Ravichandran and Ramaswami 1991). But, in Bangladesh very few experiments have been done on the effect of TIBA on the growth, yield and yield components of soybean (Fattah and Khan 1977 and Chowdhury *et al*. 1978).

Therefore, the present investigation was undertaken to study the effect of TIBA on growth and yield of BARI soybean-5 grown in Bangladesh.

Materials and Methods

The field experiment was conducted in the research field of the Department of Botany, University of Dhaka during the rabi season from December 2010 to April 2011. The experiment was laid out using Randomized Block Design (RBD) with factorial arrangement with three replications. The nature of the field soil was clay loam. The soil of the field was thoroughly tilled, and left for 7 days for sun drying. Cow dung at the rate of 20 ton per hectare and Urea, Triple super phosphate (TSP), Muriate of Potash (MP), Gypsum and Boron at the rate of 60, 175, 120, 115 and 10 kg per hectare respectively, were applied at the time of final land preparation. Seeds of BARI soybean-5 were obtained from Oilseeds research center of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. Seeds of uniform size were surface sterilized with 0.5% Calcium hypochlorite and then commercially available *Rhizobium* inoculum for soybean at the rate of 15g per kg of seeds were added to small amount of molasses and seeds and stirred until the seed coats were covered with inoculum. The seeds were sown on 23rd December, 2010 directly in the field in rows 15 cm apart. The first and second thinning were done at the age of 10 and 17 days respectively after emergence (DAE). Thinning was made in such as a way that healthy seedlings of uniform size and vigour were allowed to grow in each row and also to maintain the plant to plant distance at 10 cm. Regular watering and weeding were done as required. The experiment consisted of five treatments: T_0 = control, T_1 = 20 ppm TIBA, T_2 = 50 ppm TIBA, T_3 = 100 ppm TIBA and T_4= 150 ppm TIBA. Single foliar spray treatments of TIBA were applied on 40 DAE of plants.

Plant height, number of leaves per plant, fresh weight and dry weight of shoot, were recorded at an interval of 15 days starting from the age of 15 days after spray (DAS) up to harvest (75 DAS). During harvest 5 randomly selected plants from each replication were uprooted. Number of branches per plant, number of pods per plant, fresh weight of pods per plant, dry weight of pods per plant, number of seeds per pod, weight of 100 seeds and seed yield per plant were recorded after harvest. Chlorophyll pigments were determined at the age of 25, 40 and 55 DAS according to specific absorption co-efficient method of Mckinney (1940) and the formula of Maclachalan and Zalik (1963). The amounts of carotenoids were determined by the equation of Von Wettstein (1957). Data were analyzed statistically and least significance difference (LSD) test was applied for the comparison of various means (Steel and Torrie 1960) at 5% level of significance.

Results and Discussion

Results revealed that plant height of soybean at different ages was significantly influenced by TIBA treatments (Figs. 1 and 2). With the increasing concentration, there was decrease in plant height. Height of soybean plants decreased due to T_2, T_3 and T_4 treatments at all the DAS, whereas, due to T_1 decreased only at 30 DAS. Both increase

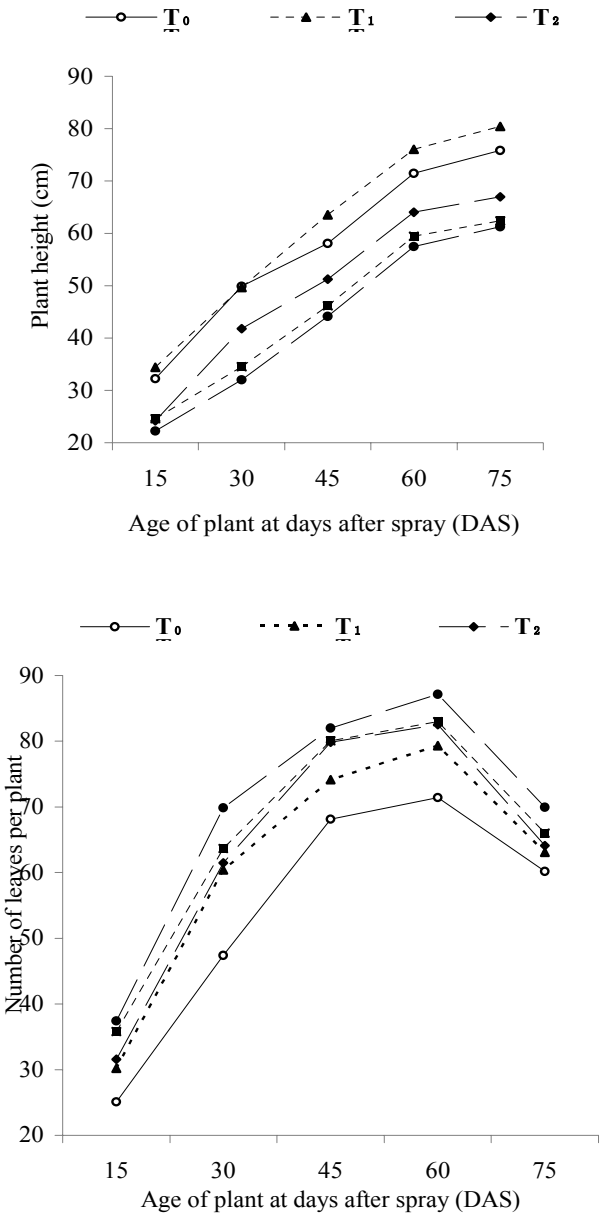

Fig. 1. Effects of TIBA on plant height and number of leaves per plant of soybean at different days after spray (DAS).

	T_0	T_1	T_2	T_3	T_4
15	8.56	9.11	9.18	9.26	9.56
30	9.33	10.09	10.38	12.03	13.74
45	11.36	13.07	13.95	14.09	17.08
60	13.31	14.08	14.2	17.8	20.41
75	15.11	16.05	20.4	21.31	26.3

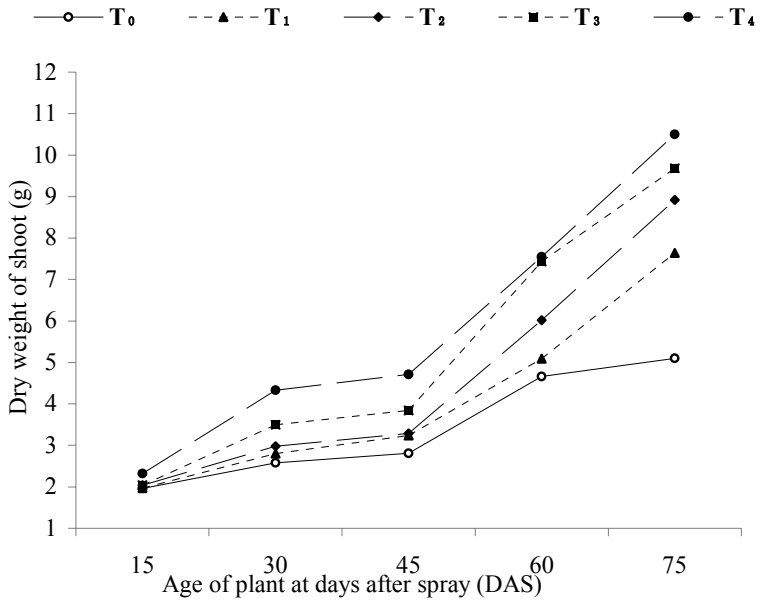

Fig. 2. Effects of TIBA on fresh weight of shoot and dry weight of shoot of soybean at different days after spray (DAS).

and decrease in plant height of soybean following TIBA application had been reported earlier (Clapp 1973 and Deotale *et al.* 1995). Thus, the results are in agreement with those of other workers.

Number of leaves of soybean plants was found to increase significantly at all the ages due to foliar application of all the concentrations of TIBA (Fig. 1). Increase in the number of leaves following TIBA application corresponds with the findings of Jahan (1998).

Dry matter of any crop is the accumulated product of photosynthesis and grain yield is positively correlated with the dry matter production after flowering (Yoshida and Ahn 1968). Fresh weight of shoot increased significantly due to TIBA treatment at all the ages except at 15 DAS (Fig. 2), whereas, dry weight of shoot increased significantly at all the ages (Fig. 2). Reports regarding increase in fresh weight of shoot due to TIBA application are very meager (Jahan 1998). Increases in dry weight of shoot of soybean following different concentrations of TIBA application have been reported by previous investigators (Ravichandran and Ramaswami 1991 and Jahan 1998). Yield of crop plant is attributed to total assimilation achieved during the growing season and the way it is proportioned between the desired storage structure and rest of the plant. The growth retardants are capable of redistribution of dry matter in the plant thereby bringing about improvement in yield (Chetti 1991).

Results of the yield parameters presented in Table 1 shows that almost all the yield components were increased following TIBA treatment. Number of branches per plant increased significantly following all the TIBA treatments and the increases were 19.52, 52.19, 77.02 and 111.55% due to T_1, T_2, T_3 and T_4 treatments respectively. Stimulation of number of branches in the present investigation corroborates earlier reports (Chung and Kim 1989).

Table 1. Effects of TIBA on yield components and yield of soybean.

Treatments	Branches /plant (no.)	Pods/ plant (no.)	Fresh weight of pods/plant (g)	Dry weight of pods/ plant (g)	Seeds/ pod (no.)	100 seed weight (g)	Seed yield/ plant (g)
T_0	7.53 e	39.20 a-d	24.30 bc	11.10 bc	2.53	9.18 cd	6.87 cd
T_1	9.00 d	36.00 de	20.08 e	8.83 de	2.53	9.28 c	6.72 c-e
T_2	11.46 c	39.70 a-c	21.86 d	9.79 d	2.53	9.18 c-e	7.38 c
T_3	13.33 b	40.20 ab	24.88 b	11.84 b	2.80	10.32 b	8.16 ab
T_4	15.93 a	40.60 a	28.22 a	14.50 a	2.86	10.47 a	8.35 a
CV (%)	27.56	13.39	13.46	21.03	18.08	5.26	14.69
LSD (0.05)	0.578	3.69	1.52	1.04	NS	0.11	0.68

Mean in a vertical column followed by same letter or without letter do not differ significantly at 5 % level.

Number of pods per plant is an important factor for soybean yield. Results obtained during the present study indicated that pods per plant, increased following T_2, T_3 and T_4 treatments by 1.275, 2.551 and 3.571% respectively, and due to T_1 treatment pods per plant decreased by 8.163 %. Results also revealed that number of seeds per pod of soybean increased non-significantly following T_3 and T_4 treatments. However, due to T_1 and T_2 treatments, number of seeds per pod was not influenced. Fresh weight and dry weight of pods per plant were significantly affected by TIBA treatments. Fresh weight and dry weight of pods per plant of soybean increased following T_3 and T_4 treatments and decreased due to T_1 and T_2 treatments. Chowdhury *et al*. (1978) and Chung and Kim (1989) reported increases in number of pods per plant in soybean following TIBA application. More reports regarding increase in number pods per plant and number of seeds per pod in soybean due to TIBA application are also available (Ravichandran and Ramaswami 1991 and Jahan 1998). However, Fattah and Khan (1977) reported both increase and decrease in number of pods per plant in soybean following application of different concentrations of TIBA.

Weight of 100 seeds is an index of seed size and is also related to the seed yield (Kambel 1969). Results also indicated that 100 seed weight increased following TIBA treatments. The range of increases in 100 seed weight was 13.927-1.056%, the maximum being due to T_4 treatment. Similar results of increase in 100 seed weights in soybean following TIBA application by different workers are available (Chowdhury *et al.* 1978, Ravichandran and Ramaswami 1991 and Jahan 1998).

Yield per plant increased significantly following T_2, T_3 and T_4 treatments. The highest increase was recorded from the plants treated with T_4 treatment and it was 21.50% over the control plant values. The other increases were 7.317 and 18.81% following T_2 and T_3 treatments respectively. Yield per plant due to T_1 treatment decreased by 2.269 %. Chowdhury *et al.* (1978) reported that appreciable increases in yield may be obtained by treating soybean with an appropriate concentration of TIBA. Increases in yield per plant of soybean due to different concentrations of TIBA had also been reported by other workers (Ravichandran and Ramaswami 1991 and Jahan 1998). Both increases and decreases in seed yield per plant of soybean due to application of TIBA were reported by Fattah and Khan (1977). Thus, the findings of the present investigation about the seed yield are in conformity with the findings of many other investigators who have observed that yield of TIBA treated plants may increase or decrease depending on the concentrations used and also on the variety

Chlorophyll is related to yield in plants as utilization of solar energy mainly depends on the relative amount of efficiency of the photosynthetic pigments. It has been observed that in many cases TIBA stimulate photosynthesis owing to increased assimilative area and thereby resulting better growth, development and higher yield. Results showed that influence of TIBA on pigment content of soybean leaf were non-significant at all the ages

except carotenoids at 55 DAS (Table 2). Chlorophyll a and b increased following 150 ppm TIBA treatment at all the ages, whereas, following 20 and 100 ppm treatments these pigments decreased. However, application of 150 ppm TIBA increased carotenoids at 40 and 55 DAS. Jahan (1998) had observed both increase and decrease in pigment content of soybean leaf due to TIBA application.

Table 2. Effects of TIBA on pigment content (mg/g) of soybean leaf at different days after spray.

Treatments	Days after spray								
	25			**40**			**55**		
	Chl. a	Chl. b	Carotenoids	Chl. a	Chl. b	Carotenoids	Chl. a	Chl. b	Carotenoids
T_0	5.43	2.96	35.87	4.84	2.37	27.23	2.75	1.56	16.56 a-d
T_1	5.12	2.75	35.73	4.66	2.05	28.40	2.35	1.37	16.72 a-c
T_2	5.35	3.07	36.00	4.41	2.03	25.89	3.39	1.90	20.51 ab
T_3	4.65	2.90	20.03	4.61	2.36	30.46	1.90	1.10	14.37 b-d
T_4	5.87	3.24	34.20	4.86	2.50	31.89	3.67	2.01	22.16 a
CV (%)	17.26	20.46	17.446	21.02	18.07	18.67	46.64	42.67	33.67
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	6.54

Mean in a vertical column followed by same letter or without letter do not differ significantly at 5 % level.

The yield potential of green plants is related to its chlorophyll content and also to the dry matter content of the plant. Hence, increase in yield of the soybean var. BARI soybean- 5 may possibly be due to the enhancement of chlorophyll content and dry matter production. Therefore, from the above discussion, it is evident that higher doses (150 ppm) of TIBA produced better stimulations on BARI soybean-5. With the increase in concentration of TIBA plant height was reduced, whereas, number of leaves per plant and number of branches per plant increased. Number of pods per plant, number of seeds per pod and 100 seed weight also increased with the increasing concentrations, thus leading to higher seed yield per plant, the maximum being due to 150 ppm TIBA treatment.

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