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Study on triacontanol on biochemical attributes and yield of sesame (*Sesamum indicum* L.)

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Abstract
Triacontanol a functioning development substance, a part of epicuticular waxes of alfa-alfa which at low focuses expanded the development and yield of oil yielding harvest sesame. Miracuian expanded chlorophyll, carotenoid dry weight and grain yield by foliar application during preflowering, blossoming and post blooming stages at various focus levels (2, 4, 6, 8 and 10 ppm). Among all the fixations applied 4 ppm was seen as successful and development advancing than different focuses and control.

Keywords: triacontanol, biochemical attributes, yield, sesame, *Sesamum indicum* L.

Introduction
Sesame is one of the most significant oil crops in Yield of Sesame with 1-Napthalene Acetic Acid (NAA) Bangladesh and developed in all areas. In the time of 1999-2000, the yield secured a territory of 96000 sections of land in Bangladesh with creation of 25000 M tons. Late BBS (2013) announced that 84310 sections of land of land developed for sesame and creation was 30972 metric tons. Along these lines, these information recommend that in spite of the fact that the place that is known for development of sesame is diminishing while the creation is expanding pattern from 1999 to 2013. Be that as it may, in a perspective on populace development, the prerequisite of consumable oil is expanding with high popular than the creation. It is in this manner, profoundly expected that the creation of consumable oil ought to be expanded impressively to satisfy the expanding request.

Indian oilseed's yield are around half of the world average and almost one- third that of the leading producers in the world. Besides this oil seeds constitute a significant place in India's national economy contributing about 6% of the national income and their products earn valuable foreign exchange for the country. The cultivation of oil seeds provides employment to about 14.5 Million persons in different activities of marketing and processing.

Sesame (*Sesamum indicum* L.) is a bloom bearing every year developed oil crop under the group of Pedaliaceae. The world collected about 4.76 million metric huge amounts of sesame seeds in 2013 and the biggest maker was Burma. The world's biggest exporter of sesame seeds was India and Japan was the biggest shipper since they use sesame seed in pastry kitchen industry. The nutritive estimation of sesame is phenomenal because of the most steady vegetable oils, with long timeframe of realistic usability, the elevated level of common cell reinforcements: sesamin, sesamolin, and sesamol which hinder the advancement of rancidity in the oil. The flour that remaining parts after oil extraction is called sesame supper which is an incredible high-protein feed for poultry and animals.

As indicated by development and creation it possesses third situation as an oil crop in Bangladesh followed by rapeseed and mustard. By and by, Bangladesh faces an intense deficiency of eatable oil because of inadequate creation of cooked oil in the nation. Our creation just guarantees 4 g of oil for each individual while each man can devour 10 g of oil day-1, demonstrates that additional 6 g included through import from other oil delivering nations. Independently, it has been suggested that a grown-up ought to devour 22 g oil day-1 for better wellbeing. Accordingly we are encountering 70% shortage of eatable oil till to date. To satisfy up the need of consumable oil we are burning through 160 million US dollar consistently.

Material and Method

The oil seed crops occupy an important place in agricultural economy in India, contributing about 6% of the national income and their products earn valuable foreign exchange for the country. There are about nine important cultivated oil seed crops commonly grown in India *viz*., groundnut, mustard, safflower, sesame, sunflower, castor, Niger, linseed and cotton. Oil seeds are the main source of vegetable fats as well as cheap and rich source of protein in predominently vegetarian diet of people all over the world. The vegetable oil (drying and semidrying oil) not only form the essential part of human diet but also serves as an important raw material for industries and in manufacturing of various other products.

All the data collected on growth, productivity and biochemical attributes were subjected to statistical analysis of variance subjected to randomised black design as described by Panse and Sukhatme (1985).

Results and Discussion

The outcome got from the perception taken during the investigation of Miraculan on development, profitability and biochemical boundaries in three oil seed crops (Mustard, Safflower and Sesame) are created in the tables from 1-3 and figures 1-3.

Miraculan increase the shoot length with all the concentrations from 2 to 10 ppm. The gradual increase was noted from 35 to 65 DAS as compared to control. In case of mustard plants, the increase of shoot length was recorded from 1.29 to 34.96% over control. The maximum increase with 2ppm was recorded i.c. 34.96%, 25.88%, 18.37% at 35, 50 and 65 DAS, respectively as compared to control as shown Table-1.

Table 1: Effect of triacontanol on the shoot length (cm) in different oil seed crops at different stages of growth (All the data are of three replicates)

DAS / Conc. (ppm)	Mustard			Safflower			Sesame		
	35	50	65	35	50	65	35	50	65
Con.	42.76 ±0.37	63.28 ±0.14	80.43 ±0.35	26.12 ±0.14	41.67 ±0.14	72.86 ±0.02	34.67 ±0.14	43.66 ±0.03	76.6 ±0.22
2	65.53 ±0.40	85.11 ±0.45	98.78 ±1.12	32.33 ±0.55	47.33 ±0.15	84.27 ±1.12	40.33 ±0.18	48.12 ±0.04	85.2 ±0.36
4	60.83 ±0.12	80.35 ±0.39	91.38 ±1.31	30.67 ±0.31	45.67 ±0.34	80.15 ±0.55	38.33 ±3.5	46.00 ±0.12	84.0 ±1.35
6	55.14 ±0.29	69.50 ±0.12	88.26 ±0.55	28.33 ±0.24	44.00 ±0.12	76.63 ±0.35	37.00 ±0.22	45.67 ±0.03	82.0 ±0.33
8	50.18 ±0.23	65.78 ±0.03	84.06 ±0.09	27.67* ±0.16	42.00* ±0.31	73.25* ±0.22	36.33* ±0.15	44.33* ±1.12	80.33* ±0.37
10	43.28* ±0.31	64.00* ±0.40	81.75* ±0.02	26.25* ±0.09	41.85* ±0.06	72.96* ±0.12	35.15* ±0.16	43.82* ±0.35	78.33* ±0.25
C.D. at 5% level	**1.46**	**2.12**	**2.37**	**1.57**	**2.35**	**2.12**	**2.13**	**2.12**	**1.45**

DAS : Days after sowing , Conc. : Concentration , * : Non-Significant , Con. : Control

Overall, cumulative effect of two doses of Miraculan that is from pre-flowering to flowering shows greater increase as compared from flowering to post flowering. The increase in shoot length was still more with three cumulative doses of 8 and 10 ppm than that of the control.

In case of safflower, the increase in shoot length recorded with all the concentrations, from 2-10 ppm (overall 0.14 to 19.20%) as compared to control. All the concentrations except 8 and 10 ppm showed a significant increase in shoot length. The optimum increase was observed with 2 ppm i.e. 19.20%, 11.95% and 13.35% at 35, 50 and 65 DAS, respectively as shown Table-1. Initially at pre-flowering stage (35 DAS) Miraculan 2, 4 and 6 ppm was more effective as compared to 50 and 65 DAS.

The data recorded for root length showed higher increase from vegetative to flowering than flowering to post flowering. In case of mustard plants, 2 ppm was the most effective dose, from 35 to 65 DAS with 3 doses. The cumulative effect was higher with 2, 4, and 6 ppm than control. 10ppm of miraculan showed non-significant change at all the observations in mustard as shown in Table-2.

Table 2: Effect of triacontanol on the root length (cm) in different oil seed crops at different stages of growth (All the data are average three replicates)

DAS / Conc. (ppm)	Mustard			Safflower			Sesame		
	35	50	65	35	50	65	35	50	65
Con.	7.53 ±0.12	13.00 ±0.31	16.12 ±0.04	16.33 ±0.41	19.40 ±1.23	23.42 ±0.11	9.33 ±0.01	16.50 ±0.33	21.00 ±1.13
2	10.70 ±0.02	16.26 ±0.21	20.16 ±1.11	19.44 ±0.23	23.27 ±0.35	30.72 ±0.03	12.23 ±0.33	21.24 ±0.26	27.25 ±1.22
4	10.12 ±0.06	15.12 ±0.22	19.00 ±0.35	18.40 ±0.30	22.63 ±0.60	27.83 ±0.22	11.53 ±0.34	19.30 ±1.15	26.12 ±0.46
6	9.75 ±0.12	14.36 ±0.05	18.26 ±0.21	17.23 ±0.05	21.33 ±0.33	26.12 ±1.12	10.12 ±0.15	18.28 ±0.34	23.83 ±0.35
8	9.05 ±0.45	13.67* ±0.30	17.00 ±1.12	16.75 ±0.14	20.47 ±1.20	24.07 ±0.45	9.85* ±1.12	17.40 ±0.42	22.25* ±0.33
10	7.60* ±1.21	13.33* ±1.21	16.40* ±0.35	16.47* ±0.11	20.12* ±0.45	23.67* ±0.32	9.42* ±0.54	17.00* ±0.15	22.00* ±0.15
C.D. at 5% level	**1.20**	**0.75**	**0.84**	**1.12**	**0.95**	**0.98**	**1.34**	**0.72**	**1.41**

DAS : Days after sowing , Conc. : Concentration , * : Non-Significant , Con. : Control

Overall, the maximum increase in root length was 30.0%, 31.25% and 29.15% at 35, 50 and 65 DAS, respectively with 2 ppm in comparison with control. Safflower and sesame also showed similar increasing effect of miraculan on lateral branches but the maximum increase was 43.00% in case of safflower with 2 ppm concentration over control. The cumulative effect of all the concentrations except 10 ppm showed the number of increased laterals from 1 to 3. In sesame, the maximum increase recorded with 2 ppm i.e. 42.82%, 44.23% and 44.35% at 35, 50 and 65 DAS, respectively over control as shown Table-3.

Table 1: effect of triacontanol on the number of branches/plant in different oil seed crops at different stages of growth (All the data are of three replicates)

DAS / Conc. (ppm)	Mustard			Safflower			Sesame		
	35	50	65	35	50	65	35	50	65
Con.	3.0 ±0.34	6.0 ±0.35	7.3 ±2.05	3.0 ±1.30	6.3 ±1.22	11.0 ±0.35	2.0 ±0.54	2.7 ±0.35	3.3 ±1.32
2	5.3 ±1.12	8.3 ±0.75	10.0 ±0.34	5.7 ±0.30	10.0 ±0.80	14.0 ±1.25	3.5 ±0.67	5.0 ±0.33	6.7 ±1.33
4	5.0 ±0.54	7.6 ±0.15	9.3 ±0.35	4.0 ±0.15	9.7 ±0.73	13.0 ±1.22	3.0 ±1.23	4.3 ±0.76	5.5 ±0.64
6	4.7 ±0.94	7.0 ±0.34	9.0 ±0.73	3.7 ±0.33	9.2 ±0.25	12.0 ±0.46	2.5 ±1.15	4.0 ±0.34	4.3 ±0.33
8	4.0 ±1.22	6.7 ±0.33	7.7 ±0.33	3.3 ±1.25	8.3 ±0.35	11.7 ±0.36	2.3 ±0.73	3.0 ±0.35	4.6 ±0.45
10	3.3* ±0.32	6.3* ±1.25	7.5* ±0.45	3.0* ±0.45	6.7* ±0.73	11.3* ±0.45	2.0* ±0.33	2.8* ±0.45	3.3* ±0.33
C.D. at 5% level	**0.34**	**0.45**	**0.23**	**0.32**	**0.42**	**0.32**	**0.26**	**0.16**	**0.32**

DAS : Days after sowing , Conc. : Concentration , * : Non-Significant , Con. : Control

In this case, the number of laterals in 2 ppm were more as compared to other treatments and control. As it is clear as shown in Fig. 1.

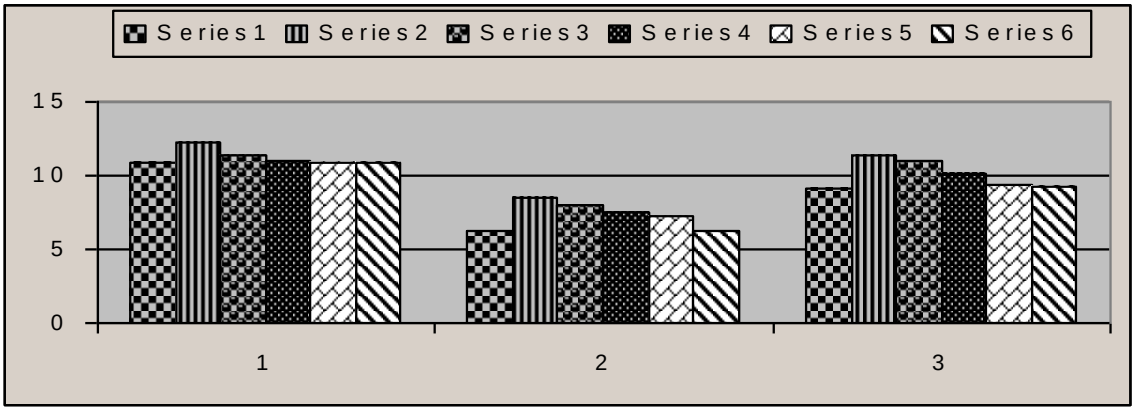

Fig 1: Effect of Triacontanol on the Total Seed Yield per hectare (q/ha) in Mustard, Safflower and Sesame.

All the concentrations significantly enhanced the total yield (q/ha) except 10 ppm in mustard, safflower and sesame. In mustard the maximum increase noticed was 11.96% over control. In safflower and sesame total seed yield increased up to 26.71% and 20.14% with 2 ppm of miraculan as compared to control. Overall, miraculan proved to be more beneficial in case of safflower as compared to mustard and sesame.

The data collected on economic yield over biological yield on the basis of harvest index clearly showed that 2 ppm is the most effective concentrations, Harvest index was increased significantly with all the concentration except 10 ppm. The increase recorded from 3.13% to 36.84% in mustard, 1.43% to 22.27% in safflower and 1.55% to 18.20% in sesame, over control as shown in Fig.-2).

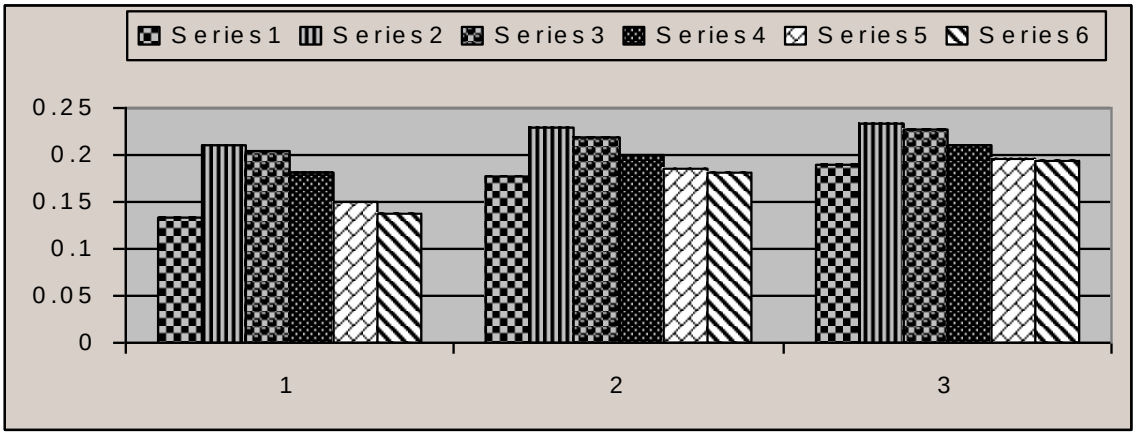

Fig 2: Effect of Triacontanol on the Harvest Index in Mustard, Safflower and Sesame

The leaves collected at three different stages of growth, in all the three oil seed crops, showed differently increased chlorophyll content (mg/g fresh wt). All the concentrations significantly enhanced the photosynthetic pigment except 10 ppm of miraculan. In case of mustard and sesame 2, and 4 ppm enhanced chlorophyll content from 35 to 65 DAS, while in safflower only 2 ppm showed the increasing trend as shown in Fig.-3).

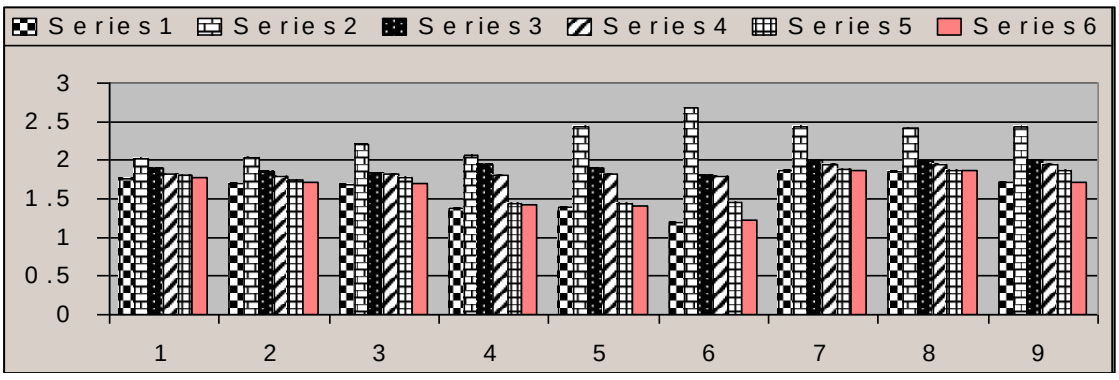

Fig 3: Effect of Triacontanol on the Chlorophyll Content in leaves (mg/g fresh wt.) of Mustard, Safflower and Sesame at different stages of growth

TRIA is a constituent of plant wax and regulates the metabolic pathway. The effect of TRIA enhanced the uptake of nutrients, increased photosynthesis and yield in many agricultural crops. From the findings of this experiment, it is clear that all the three oil seed crops responded to the treatment of miraculan as foliar spray. As it is clear from the observations that exogenously applied miraculan significantly improved the growth and yield parameters. In present studies, the plant height significantly increased with lower concentrations and 2 ppm was the most effective concentration.

Conclusion

The Oil-seed crops involve a significant spot in agricultural economy of India comprising the primary business crops and the second rural harvests to the food grains. There are around nine significant developed oil-seed crops, out of which safflower, mustard and sesame are significant ones. Oil seeds are the primary wellspring of vegetable fat. The vegetable oil isn't just structure the fundamental piece of human weight control plans yet additionally fill in as a significant crude material for the agro based businesses and the producer of different other modern items. Another significant item from oil-seeds is oil cake, is utilized for animals taking care of and as compost in the cultivating.

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