



## Field Level Study on The Utilization of Dyeing Industry Effluent Residue on Growth of Lady's Finger *Abelmoschus Esculentus*

<b>M.R.Rajan</b>	Department of Biology, Gandhigram Rural Institute – Deemed University Gandhigram-624 302, Tamil Nadu, India
<b>S.David Noel</b>	Department of Biology, Gandhigram Rural Institute – Deemed University Gandhigram-624 302, Tamil Nadu, India
<b>M.Veerakumar</b>	Department of Biology, Gandhigram Rural Institute – Deemed University Gandhigram-624 302, Tamil Nadu, India

### ABSTRACT

The present study deals with the field level study on the impact of different quantities of dyeing industry effluent residue (0, 200, 400, 600, 800, 1000 and 1200 mg) on growth, biochemical characteristics and yield of Lady's finger *Abelmoschus esculentus*. The growth characteristics of Lady's finger *Abelmoschus esculentus* such as seed germination percentage, shoot length, root length, total fresh weight, total dry weight, leaf area index and vigour index were higher in T<sub>4</sub> with 800mg and lower in T<sub>6</sub> with 1200 mg of dyeing industry effluent residue on 45th day. The chlorophyll a, b, total chlorophyll, carotenoid and total soluble protein content of Lady's finger was higher in T<sub>4</sub> and lower in T<sub>6</sub>. The total sugar of Lady's finger was higher in T<sub>4</sub> and lower in T<sub>6</sub>. The length, weight and number of fruits of Lady's finger were higher in T<sub>4</sub> with 800mg and lower in T<sub>6</sub> with 1200mg of dyeing industry effluent residue.

### KEYWORDS

Field level study, dyeing industry effluent, residue, growth, lady's finger

### INTRODUCTION

Industrial pollution is one of the problems presently facing in India and several efforts are being vigorously pursued to control it in various industries spanning length and breadth of the country. Textile industry is an important contributor to national economy. Due to rapid changes in customer demands, textile finishing industries are challenged to use high quantity of dyes and auxiliaries (Kumawat *et al.*, 2001). Effluent generated by the industries is one of the sources of pollution. Utilization of industrial effluents including dye industry for irrigating agricultural land has become a common practice in India. Nutrient supply is the major constraint in the development of Indian agriculture and the cost of organic fertilizer is also increasing due to excess mining of nutrients as well. It is well known fact that in the present context there is a limited availability of organic manure in agriculture due to population explosion, intensive agriculture, reduction in livestock population etc. Irrigating industrial effluent provides farmers with a nutrient enriched water supply and society with a reliable and inexpensive system for waste water treatment and disposal (Feigin *et al.*, 1991). The work related to the utilization of dyeing industry effluent residue on growth, biochemical and yield parameters of vegetable crop Lady's finger is totally wanting. In this context the present study was carried out.

### MATERIALS AND METHODS

For the present study, dyeing industry effluent was collected from Chinnalappatti, Dindigul, Tamil Nadu, India, in plastic containers (20L). After collection, the effluent was immediately transported to the laboratory for analysis and evaporated in the plastic tray (10 L) in order to collect residue. After evaporation the residue was scratched and collected for the field studies. 1gm of residue was taken in a boiling tube and digested using 10ml triple acid solution (HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub> in 9:2:1 proportion respectively) till the sample became colorless. The digested sample was filtered using Whatman No.1 filter paper two times and was made up to 50ml and it was subjected to analysis of zinc using Atomic Absorption Spectrophotometer (AAS). The residue was standardized for the present study by a pilot study with different quantities from 200 to 2000 mg. From the pilot study it was observed

that the dyeing industry effluent residue beyond 1200 mg is not suitable for germination. Hence, in the present study, the quantities between 200 and 1200 mg of dyeing industry effluent residue were chosen. The experimental field is located at KVK (Krishi Vigyan Kendra), Gandhigram, Dindigul district and is situated in the central region of Tamilnadu at 10° 3' N latitude and 77° 15' E longitudes. The field experiment was laid out in Randomized block design. The field was ploughed three times and brought to a fine tilth at the last ploughing. The experimental plants in field trial had seven treatments supplied with different quantities of dyeing industry effluent residue such as 0, 200, 400, 600, 800, 1000 and 1200 mg for treatment 0 (control), 1, 2, 3, 4, 5 and 6 respectively and had three replications in the field layout. The experimental field was irrigated by well water. Ten plants were raised in each micro plot with appropriate spacing between rows and plants. The growth parameter such as shoot and root length, fresh and dry weight, vigour and leaf area index, biochemical parameters such as chlorophyll a, chlorophyll b, total chlorophyll, carotenoides, anthocyanin, total soluble sugar, total soluble protein, L-proline, free amino acids and leaf nitrate and yield were estimated after 45 days.

### RESULTS AND DISCUSSION

Impact of different quantities of dyeing industry effluent residue on growth characteristics of Lady's finger *Abelmoschus esculentus* is presented in Table 1. The germination efficiency was higher in T<sub>4</sub> (100%) and lower in T<sub>6</sub> (60%). Kaushik *et al.*, (2005) reported that the dyeing industry effluent shows better result with 50% water diluted effluent samples than 100% effluent. It clearly in that the decreased load of the concentration in the effluent leads to improved germination and growth of the plants. Vijayakumari (2003) reported that soap factory effluent was toxic to seed germination of finger and pearl millet, but when the effluent was diluted to 2.5 to 5.0% it enhanced the seed germination. In the present study, the shoot length, root length, total fresh weight was higher in T<sub>4</sub>. Rani and Alikhan (2007) reported that the lower concentration (25%) of distillery effluent showed higher rate of root length, shoot length, total fresh weight and total dry weight. Sreya Basu (2013) reported that the shoot and root length de-

creased with increasing concentration of treated chrome plating industry effluent on Cow pea. Azra *et al.*, (2011) reported that the both total fresh and dry weight enhanced in higher concentration (80%) textile mill effluent.

**Table 1 Impact of different quantities of dyeing industry effluent residue on growth**

Parameters	Treatments							
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>
Germination(%)	79	80	90	93	100	70	60	
Shoot length (cm)	20.5 ± 0.10	25.3 ± 0.04	29.8 ± 0.07	33.4 ± 0.11	42.0 ± 0.08	37.8 ± 0.10	22.5 ± 0.01	
Root length (cm)	11.5 ± 0.01	15.8 ± 0.05	17.6 ± 0.01	20.6 ± 0.10	22.5 ± 0.80	14.3 ± 0.01	10.3 ± 0.03	
Total Fresh weight(g)	15.7 ± 0.02	17.4 ± 0.09	22.6 ± 0.04	25.3 ± 0.03	28.1 ± 0.80	19.6 ± 0.28	14.1 ± 0.05	
Total Dry weight (g)	0.35 ± 0.02	0.51 ± 0.09	0.62 ± 0.04	0.73 ± 0.03	0.95 ± 0.80	0.86 ± 0.20	0.67 ± 0.05	
Leaf area index (cm <sup>2</sup> )	21 ± 0.70	25 ± 0.01	26 ± 0.06	35 ± 0.80	43 ± 0.01	25 ± 0.06	17 ± 0.03	
Stem index (%)	2560 ± 0.01	3268 ± 0.00	4860 ± 0.06	4950 ± 0.10	6490 ± 0.80	3673 ± 0.90	1625 ± 0.05	

All the values are averages of five individual observations from triplicate. Mean±SE

Impact of different quantities (200, 400, 600, 800, 1000 and 1200 mg) of dyeing industry effluent residue on biochemical characteristics of Lady's finger *Abelmoschus esculentus* on 45<sup>th</sup> day are presented in Table 2. The chlorophyll *a*, *b* and total soluble sugar, total soluble protein and L-proline were higher in T<sub>4</sub>. Rajan *et al.* (2013 & 2014) reported similar result when black gram & cluster bean was grown in zinc electroplating industry effluent residue. Dhanam *et al.* (2009) reported that the biochemical parameters *viz.*, chlorophyll, carotenoids, total sugars, starch, protein and amino acid contents increased at lower concentrations and maximum increase at 25% concentration. Enhancement of chlorophyll could be due to high nutrient uptake, synthesis and amino acid translocation probably facilitated by optimum availability of iron and magnesium and also due to reduction in phenol content in the treated dairy effluent. The L-proline content was higher at T<sub>6</sub> and lower in T<sub>4</sub>. The leaf nitrate of Lady's finger was higher in T<sub>4</sub> (1000mg). Dilshadatabassum *et al.*, (2013) reported that higher concentration (100%) of industry effluent increased leaf nitrogen in Mustard.

**Table 2 Impact of different quantities of dyeing industry effluent residue on biochemical**

Parameters	Treatments							
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>
Chlorophyll a (mg/g fr)	1.02±0.53	2.07±0.27	1.62±0.34	3.75±0.54	4.86±0.88	3.11±1.21	1.21±0.33	
Chlorophyll b (mg/g fr)	1.10±0.05	2.11±0.20	3.50±0.89	4.60±0.75	5.53±0.33	6.62±0.88	1.01±0.42	
Total Chlorophyll (mg/g fr)	2.12±0.41	4.18±0.47	5.22±0.84	8.35±0.89	10.30±0.12	9.73±0.82	2.22±0.88	
Carotenoid (µmol/g fr)	0.86±0.42	1.89±0.14	2.85±0.16	3.92±0.01	4.79±0.02	4.04±0.10	3.45±0.01	
Anthocyanin (µmole/g fr)	3.33±0.01	3.44±0.04	2.61±0.06	2.44±0.08	2.33±0.63	6.24±0.25	6.50±0.86	
Total sugar (µmole/g fr)	6.54±0.09	9.14±0.14	11.09±0.08	11.45±0.12	11.70±0.09	5.72±0.24	5.98±0.81	
Total protein (mg/g fr)	5.80±0.26	7.59±0.29	9.62±0.40	10.26±0.24	11.09±0.27	9.08±0.96	8.81±0.21	
L-proline (mg/g fr)	3.21±0.46	3.06±0.60	2.85±0.24	2.50±0.84	1.32±0.72	0.05±0.42	7.10±0.83	
Free amino acid (mg/g fr)	3.51±0.01	2.82±0.23	3.56±0.07	3.32±0.08	5.76±0.02	5.80±0.02	7.2±0.02	
Leaf nitrate (mg/g fr)	8.50±0.10	8.20±0.99	5.83±0.66	5.58±0.03	5.12±0.02	8.22±0.01	8.81±0.02	

All the values are averages of five observations. Mean±SE

Impact of different quantities (200, 400, 600, 800, 1000 and 1200 mg) of dyeing industry effluent residue on yield of Lady's finger *Abelmoschus esculentus* is presented in Table 3. The length, weight and number of fruits were higher in T<sub>4</sub>. Diluted paper mill effluent increased the height of plant, number of pods per plant and weight of pods in pea and rice (Yoshida 1972). Mahimairaja and Bolan (2004) reported that low doses of distillery spent wash remarkably improve the yield of dry land crops (ragi, ground nut, sorghum and green gram).

**Table 3 Effect of various quantities (0,200, 400, 600, 800, 1000 and 1200 mg) of dyeing industry effluent residue on Length (cm), Weight (g) and Number of Lady's finger Abelmoschus esculentus.**

Treatment	Length	Weight	
	Number		
T <sub>0</sub>	8.2 ± 0.04	4.5 ± 0.12	6.0 ± 0.06
T <sub>1</sub>	11 ± 0.30	9.8 ± 0.11	9.0 ± 0.06
T <sub>2</sub>	11 ± 0.01	10 ± 0.20	11 ± 0.01
T <sub>3</sub>	13 ± 0.04	11 ± 0.12	12 ± 0.06
T <sub>4</sub>	14. ± 0.03	13 ± 0.70	15 ± 0.03
T <sub>5</sub>	9.1 ± 0.10	6.2 ± 0.02	8.0 ± 0.60
T <sub>6</sub>	7.6 ± 0.09	4.6 ± 0.50	5.0 ± 0.07

**ACKNOWLEDGMENT:** Authors are thankful to Department of Biology, Gandhigram Rural Institute-Deemed University, Gandhigram, India for offering facilities to carry out this research work.

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