Journal of Pharmacognosy and Phytochemistry 2020; 9(3): 1027-1030

Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 1027-1030
Received: 12-03-2020
Accepted: 16-04-2020

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Effect of algal extract on the seedling attributes of important vegetables and field crops

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Abstract
Objective: A laboratory experiment was conducted to know the effect of BGA extract on seedling growth.
Methods: Different concentrations of algal extract were used for seed treatment (25%, 50%, 75%, 100% and untreated) in crops *viz*., Chilli, Tomato, Carrot, Beans, Maize, Paddy and Ragi were. Then the observation on shoot length, root length, seedling length and seedling dry weight were recorded.
Results: In this study significantly higher (11.45 cm) shoot length was recorded in BGA @100%. Significant differences were recorded among the crops when they subjected for various concentrations of BGA for shoot length. Significantly higher (18.93 cm) root length was observed in Maize and lower (6.99 cm) shoot length was recorded in Cucumber. Meanwhile, higher (11.57 cm) root length was recorded in BGA @ 50% concentration. Among crops higher (21.22 cm) root length was observed in Maize and lower (5.52 cm) root length was recorded in Ragi. However, higher (22.42 cm) mean seedling length was recorded in BGA @75% concentration. Significantly higher (40.14 cm) seedling length was observed in Maize and lower (12.92 cm) seedling length was recorded in Ragi. Seedling dry weight varied significantly, higher (21.26 mg) Seedling dry weight was recorded in BGA @100% concentration meanwhile, higher (63.71 mg) seedling dry weight was observed in Maize and lower (4.22 mg) seedling dry weight was recorded in Carrot. And lower shoot length (7.99 cm), root length (8.05 cm), seedling length (16.04 cm) seedling dry weight (16.85 mg) were observed in control.
Conclusion: The results revealed that algal extract able to increase the seedling growth.

Keywords: Germination, BGA extract, seedling length, seed treatment

1. Introduction
Blue-green algal extract excretes a great number of substances that influence plant growth and development (Ordog, 1999) [9]. These microorganisms have been reported to benefit plants by producing growth promoting regulators (the nature of which is said to resemble gibberellin and auxin), vitamins, amino acids, polypeptides, antibacterial and antifungal substances that exert phytopathogen biocontrol and polymers, especially exopolysaccharides, that improve plant growth and productivity (Zaccaro *et al*., 1999) [11]. Moreover, Zaccaro *et al.* (2001) [10] reported that, foliar application of biochemical organic substances, which supply macro and micro nutrients, of increased demand.
Fresh water algae contain high percentage of macro and micronutrients bounded in their major biochemical constituents and metabolites such as carbohydrates and proteins (Wake *et al*., 1992; Nagaraj *at al*., 2016) [8]. In this respect, Adam (1999) [2] found that algal filetrate of the cyanobacterium Nostoc muscorum significantly increased germination of wheat seeds as well as their growth parameters and nitrogen compounds, compared to controls. Also, Lozano *et al.* (1999) [5] stated that, the application of an extract from algae to soil or foliage increased ash, protein and carbohydrate contents of potatoes (Solanum tuberosum).
Recently, Ghallab and Salem (2001) [4] studied the effect of some biofertilizer treatments; Cerealin (*Azospirillum spp*.) and Nemales (*Serratia spp*.) on wheat plant, in field experiment and found that the two biofertilizers increased growth characters and nutrients, sugar, amino acids and growth regulators (IAA, GA_3 and Cytokinin) and crude protein content in the plant. On the other hand, Abdel-Monem *et al*. (2001) [14] reported that fertilization with *Azospirillum brasilense* or commercial biofertilizer Cerealin, improve the growth and yield of maize in rotation with wheat as affected by irrigation regime.

2. Materials and Methods
The Cyanobacteria, *Spirulina nordesteii* about 5 gm algae was homogenized with 50 ml of distill water and then filtered by suction pump. The filtrate is then converted into 25%, 50%, 75% and 100% by using distilled water. These various concentrations were used for seed treatment.

The seeds of crops such as Chilli, Tomato, Carrot, Beans, Maize, Paddy and Ragi were collected from local market. The seeds were soaked in the different concentrations (25%, 50%, 75% and 100%) of *Spirulina nordesteii* extract for the period of 12 hours and the seeds were also soaked in distilled water as a control. After presoaking treatment, the seeds were transferred to sterilized petriplates and about 10ml of water was added to each petriplate. Then the observations on seed quality attributes with respect to shoot length, root length, seedling length and seedling dry weight were recorded.

Twenty seedlings selected at random from each treatment were used to work out shoot length, root length and mean seedling length and mean value was expressed in centimetres (cm). Seedlings selected for measuring seedling length were used to work out seedling dry weight. Seedlings were kept in oven at 50 °C for 48 hours and weight was measured and means value was expressed in milligrams (mg).

3. Results and Discussion

Among the different concentrations of BGA significant differences were observed for shoot length. Significantly higher (11.45 cm) shoot length was recorded in BGA @100% concentration (T_5) and it was on par with BGA @100% concentration (T_4) (11.15 cm) followed by T_3 and T_2 (10.74 and 10.38 cm, respectively) and the lower (7.99 cm) shoot length was observed in control (T_1). Significant differences were recorded among the crops when they subjected for various concentrations of BGA for shoot length. Significantly higher (18.93 cm) root length was observed in Maize (C_6) followed by Paddy (C_7) and Beans (C_5) (12.48 and 11.90 cm, respectively). Meanwhile, lower (6.99 cm) shoot length was recorded in Cucumber (C_1).

Among the different concentrations of BGA significant differences were observed for root length. Significantly higher (11.57 cm) root length was recorded in BGA @ 50% concentration (T_3) and it was on par with BGA @ 75% concentration (T_4) (11.27 cm) followed by T_5 and T_2 (10.84 and 10.48 cm, respectively) and the lower (8.05 cm) root length was observed in control (T_1). Significant differences were recorded among the crops when they subjected for various concentrations of BGA for root length. Significantly higher (21.22 cm) root length was observed in Maize (C_6) followed by Beans (C_5) and Paddy (C_7) (12.76 and 11.19 cm, respectively). However, lower (5.52 cm) root length was recorded in Ragi (C_8) (Table 1).

Among the different concentrations of BGA significant differences were observed for seedling length. Significantly higher (22.42 cm) seedling length was recorded in BGA @75% concentration (T_4) and it was on par with BGA @100% concentration (T_4) and BGA @50% concentration (T3) (22.29 and 22.31 cm, respectively) followed by BGA @25% concentration (T_2) (20.86) and the lower (16.04 cm) seedling length was observed in control (T_1) (Fig. 1).

Significant differences were recorded among the crops when they subjected for various concentrations of BGA for seedling length. Significantly higher (40.14 cm) seedling length was observed in Maize (C_6) followed by Beans (C_5) and Paddy (C_7) (24.66 and 23.67 cm, respectively). Meanwhile, lower (12.92 cm) seedling length was recorded in Ragi (C_8).

Among the different concentrations of BGA significant differences were observed for seedling dry weight. Significantly higher (21.26 mg) seedling dry weight was recorded in BGA @100% concentration (T_5) followed by BGA @75% concentration (T_4) (20.73 mg) and the lower (16.85 mg) seedling dry weight was observed in control (T_1).

Significant differences were recorded among the crops when they subjected for various concentrations of BGA for seedling dry weight. Significantly higher (63.71 mg) seedling dry weight was observed in Maize (C_6) followed by Beans (C_5) (49.82 mg). Meanwhile, lower (4.22 mg) seedling dry weight was recorded in Carrot (C_4) (Table 2) (Fig. 2).

Table 1: Influence of different concentration of BGA on root length and shoot length of various crops

	Root length (cm)						Shoot length (cm)					
Crops/Treatment	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**Mean**	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**Mean**
C_1	4.99	6.27	6.44	6.71	6.88	6.26	5.60	7.00	7.17	7.50	7.67	6.99
C_2	6.68	9.20	9.49	9.79	10.15	9.06	5.90	8.40	8.70	8.97	9.30	8.25
C_3	6.57	9.91	10.19	10.55	10.89	9.62	7.23	10.57	10.90	11.27	11.60	10.31
C_4	5.67	7.97	8.33	8.67	8.93	7.91	4.30	6.60	6.90	7.17	7.40	6.47
C_5	10.67	12.62	12.97	13.60	13.92	12.76	9.87	11.80	12.13	12.70	13.00	11.90
C_6	18.43	20.74	21.51	22.41	22.99	21.22	16.50	18.50	19.17	19.97	20.50	18.93
C_7	7.45	11.47	12.00	12.34	12.69	11.19	8.70	12.70	13.30	13.67	14.03	12.48
C_8	3.97	5.65	5.80	6.05	6.12	5.52	5.80	7.47	7.67	8.00	8.10	7.41
Mean	8.05	10.48	10.84	11.27	11.57		7.99	10.38	10.74	11.15	11.45	
	S. Em±	CD (5%)	CV (%)				S.Em±	CD (5%)	CV (%)			
C	0.105	0.296	3.898				0.225	0.632	8.415			
T	0.083	0.234					0.178	0.500				
C×T	0.235	0.661					0.502	1.414				

Treatment details

Crops (C)			**Treatments (T)**		
C_1	:	Cucumber	T_1	:	Control
C_2	:	Chilli	T_2	:	BGA (25%)
C_3	:	Tomato	T_3	:	BGA (50%)
C_4	:	Carrot	T_4	:	BGA (75%)
C_5	:	Beans	T_5	:	BGA (100%)
C_6	:	Maize			
C_7	:	Paddy			
C_8	:	Ragi			

Table 2: Influence of different concentration of BGA on seedling length and seedling dry weight of various crops

	Seedling length (cm)						Seedling dry weight (mg)					
Crops/Treatment	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**Mean**	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**Mean**
C_1	10.59	13.27	14.05	14.21	14.11	13.25	9.37	10.77	11.06	11.54	11.83	10.91
C_2	12.58	17.60	18.85	18.76	18.79	17.32	3.47	5.99	6.18	6.38	6.61	5.72
C_3	13.80	20.48	21.79	21.82	21.79	19.94	3.90	7.23	7.44	7.70	7.95	6.85
C_4	9.97	14.57	15.83	15.84	15.73	14.39	2.15	4.45	4.65	4.84	4.99	4.22
C_5	20.54	24.42	26.05	26.30	25.97	24.66	46.25	48.20	49.55	51.93	53.17	49.82
C_6	34.93	39.24	42.16	42.38	42.01	40.14	59.23	61.87	63.47	66.14	67.86	63.71
C_7	16.15	24.17	25.99	26.01	26.03	23.67	5.69	9.71	10.15	10.45	10.74	9.35
C_8	9.77	13.12	13.79	14.05	13.90	12.92	4.75	6.43	6.60	6.88	6.96	6.32
Mean	16.04	20.86	22.31	22.42	22.29		16.85	19.33	19.89	20.73	21.26	
	S. Em±	CD (5%)	CV (%)				S. Em±	CD (5%)	CV (%)			
C	0.233	0.655	4.335				0.248	0.699	4.907			
T	0.184	0.518					0.196	0.553				
C×T	0.520	1.464					0.556	1.564				

Treatment details

Crops (C)			Treatments (T)		
C_1	:	Cucumber	T_1	:	Control
C_2	:	Chilli	T_2	:	BGA (25%)
C_3	:	Tomato	T_3	:	BGA (50%)
C_4	:	Carrot	T_4	:	BGA (75%)
C_5	:	Beans	T_5	:	BGA (100%)
C_6	:	Maize			
C_7	:	Paddy			
C_8	:	Ragi			

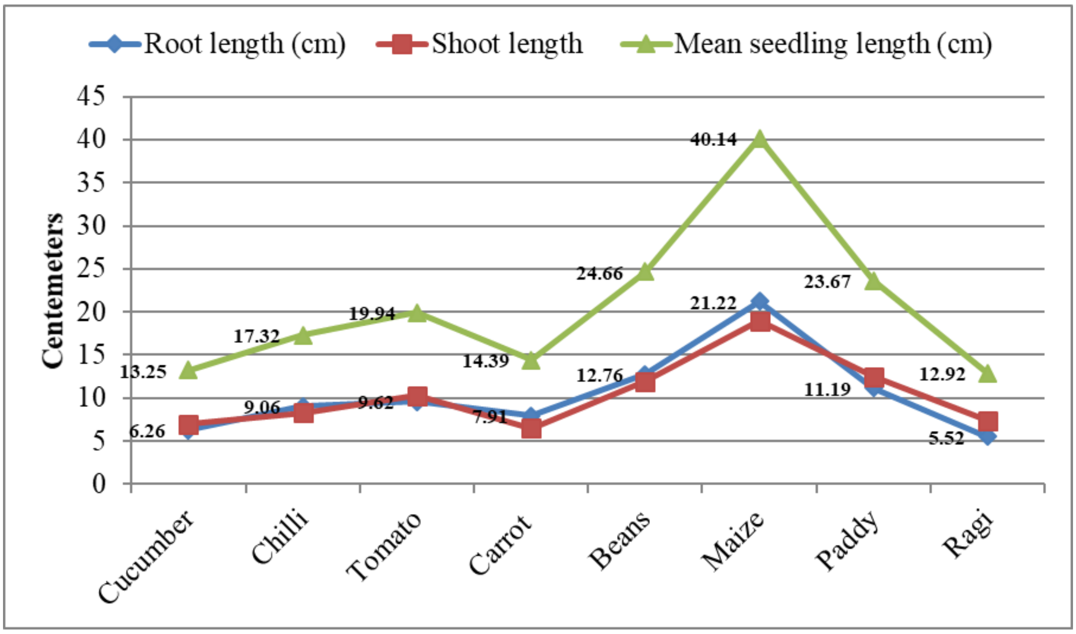

Fig 1: Effect of algal extract on root, shoot and seedling length of various crops

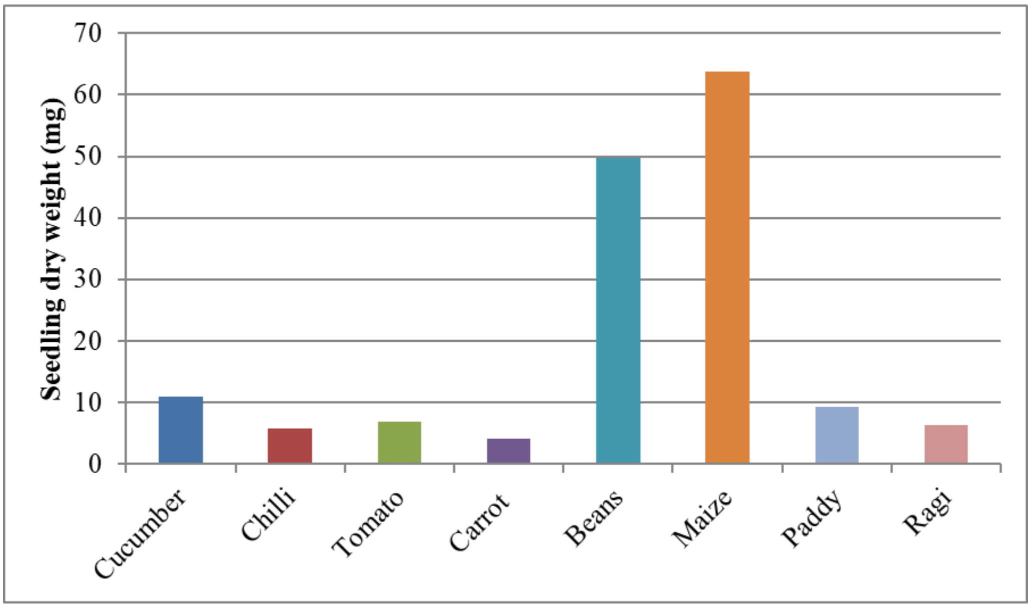

Fig 2: Effect of algal extract on seedling dry weight of various crops

4. Conclusion

A worthy content of growth hormones in BGA solution which could influenced the vigour of the produced seedlings in terms of seedling length compared to the control. In this study, the increment in seedling growth and seedling dry weight resulting from different cyanobacteria treatments was significant among crops and also between concentrations. The results are in accordance with Maiti & Pramanik, 2013 [6], used different priming techniques improved seedling vigor, growth and yield of tomato, cucumber, chilli, cabbage and watermelon crops; although the cultivars showed variation in germination percentage in responses to different treatments. In this respect, different cyanobacterial isolates showed a significant increase in percentage of germination, seedling length, seedling dry weight and other vigour parameters of maize plant (Mohan *et al*., 2015; and (Gehan and Shaimaa, 2017) [7, 3].

5. Acknowledgment

The author is thankful to all faculty of Sahyadri Science College, Kuvempu University, Shivamogga and UAS, Bangalore for providing necessary facilities to carry out the research work.

6. Conflict of Interest

The authors declare no conflict of interest.

7.Abbreviations

BGA – Blue Green Algae
IAA - Indole-3-acetic acid
GA_3 - Gibberellic acid

8. References

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