



# Effect of Seaweed Extracts on the Growth, Flower Yield and Quality of Dahlia (*Dahlia variabilis*) C.V. Aditya Birla

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: 10.9734/IJECC/2023/v13i102954

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/106001>

Original Research Article

Received: 05/07/2023

Accepted: 07/09/2023

Published: 11/09/2023

## ABSTRACT

An experiment entitled "Effect of seaweed extracts on the growth, flower yield and quality of Dahlia (*Dahlia variabilis*) c.v. Aditya Birla" was conducted to evaluate the response of dahlia to different growth regulators, Kelp @ 2ml and 4 ml and Biovita @ 2ml and 4 ml. Thirteen different treatment combinations were replicated thrice in a Randomized Completely Block Design. The investigation revealed that Biovita was very effective and recorded maximum days to seed germination, plant height, number of leaves, stem diameter, secondary branch number. Leaf area Significant influence of growth regulators was observed on various vegetative parameters. Flower diameter, flower number, diameter and fresh weight increased Significant influence of growth regulators was

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observed on various foral parameters. Highest flower numbers per plant and flower yield per ha was recorded treatment T<sub>11</sub> (4 ml L-1Biovita, 5 days interval). Treatment T<sub>11</sub> recorded higher net realization Rs. 506700 which was followed by treatment cost of cultivation with of Rs.170500.. Furthermore, highest Cost benefit ratio was recorded under treatment T<sub>11</sub> (1:2.97).

**Keywords:** Aditya birla; kelp; biovita; vegetative parameter and cost benefit ratio.

## 1. INTRODUCTION

Dahlia (*Dahlia variabilis*L.) is one of the most popular tuberous, rooted perennials, herbaceous blooming plant, esteemed for their spectacular attractive flowers, commonly known as “water cane”, “water pipe” and “hollow stem flower” because of hollowness of its stems. Dahlia being known for its dignity and royalty, it has no rival as a bedding plant for versatile beauty, even commercially and they regularly stay fresh for more than half a month relying upon cultivars [1]. Dahlia is well known bulbous flowering plant developed different parts of the world for its wonderful fancy sprouts of changing shades of hues for the beautification of beds, borders and cut blooms. The chromosome number of Dahlia variabilis L. is  $2n = 64$ . It belongs to the family Asteraceae, originated in Mexico and was declared the national flower of this country 1963, which got its name by Cavanilles in the year 1791, to commemorate the work of Swedish Botanist Dr. Andreas Dahl, a pupil of Linnaeus. Being a well-known flower florists blossom, dahlia tubers were sold each year in millions in North America and Europe [2].

Dahlia occupies a place of pride in any garden. Dahlias are easy to grow both in field and in pot and are extensively used for exhibition, garden display and home decoration. Dwarf growing types are suitable for beds and borders (pure / mixed borders). Large flowering dahlias in pots are popular for terrace garden or verandah display. Cut flowers of pompon and miniature types stay fresh flower vases for many days and also better to make moderately good garlands. The long, clean and stiff stalks, are very suitable for both cut flower and decoration purpose [3].

Evaluation is a necessary pre-requisite for crop improvement and it will provide a rapid, reliable and efficient means of information to augment the utilization of germplasm. It is the stepping stone in order to utilize any crop to its full potential. Since, the performance of each genotype varies with regions, season and growing environment, therefore testing the performance of the available genotypes for suitability and adaptability take prime importance, as the research work on this line is marga in

Himachal Pradesh. Keeping all these points in view, an investigation will be carried out to assess the performance of different cultivars for their growth and flowering characteristics under sub-montane, sub-tropical low hill zone of HP.

Dahlia is a half-hardy annual and one of the most popular of all garden annuals grown throughout the world. It can easily be grown in the open fields and poly houses for the production of cut flowers; cut-asters last long and are used in vases and floral decorations. It is an important commercial ornamental annual grown in many parts of the world for cut flowers. Plant bio-stimulants refer to the natural or synthetic substances which are applied to seeds, plants and/or soil to cause changes in structural and vital processes in plant growth [4].

The use of bio-stimulants generally increases nutrient uptake as well as nutrient use efficiency, thereby reducing the consumption of artificial fertilizers, which affect soil health tremendously. Plant bio stimulants such as protein hydrolysates and seaweed extracts are attracting the increasing interest of scientists and vegetable growers for their potential to enhance yield and nutritional quality. Bio stimulants applied in plant production have been widely considered as environmentally friendly agricultural practice and so are now among tools used in sustainable agriculture. Seaweed extracts have been used in organic agriculture to encourage the development and strengthen the quality performance of floricultural crops. The effectiveness of the seaweed extract is built entirely on hormone levels of plants or otherwise micronutrients in the crude extract. Dried or fresh seaweeds and liquid extracts have been increasingly employed by horticulturists, gardeners, farmers, and orchardists as a fertilizer. Sea. The effect of seaweed extract is due to the microelements and plant growth regulators such as cytokine present in it. Seaweed extract is used as a foliar spray, application to soil and for soaking of seeds before sowing. It enhances the germination of seeds, increases uptake of plant nutrients, and gives resistance to frost and fungal diseases. Seaweed extract is effective for increasing shelf-

life of the produce, improves the quality of produce, and serves as an excellent soil conditioner [5].

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site and Location

The experiment was conducted during kharif season of the year 2022 – 23 at Horticulture Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj.

**Table 1. Details of dahlia under experiment**

Notation	Treatments	Frequency of application
T <sub>1</sub>	Control	-
T <sub>2</sub>	2 ml L <sup>-1</sup> Kelp	5 days interval
T <sub>3</sub>	2 ml L <sup>-1</sup> Kelp	10 days interval
T <sub>4</sub>	2 ml L <sup>-1</sup> Kelp	15 days interval
T <sub>5</sub>	4 ml L <sup>-1</sup> Kelp	5 days interval
T <sub>6</sub>	4 ml L <sup>-1</sup> Kelp	10 days interval
T <sub>7</sub>	4 ml L <sup>-1</sup> Kelp	15 days interval
T <sub>8</sub>	2 ml L <sup>-1</sup> Biovita	5 days interval
T <sub>9</sub>	2 ml L <sup>-1</sup> Biovita	10 days interval
T <sub>10</sub>	2 ml L <sup>-1</sup> Biovita	15 days interval
T <sub>11</sub>	4 ml L <sup>-1</sup> Biovita	5 days interval
T <sub>12</sub>	4 ml L <sup>-1</sup> Biovita	10 days interval
T <sub>13</sub>	4 ml L <sup>-1</sup> Biovita	15 days interval

## 3. RESULTS AND DISCUSSION

### 3.1 Vegetative growth parameters in dahlia plant of various plant growth regulators

Days taken to germination of seeds of dahlia are one of the most important parameters of plant. The plots of treatment T<sub>11</sub> were observed with mean maximum plant height (24.57) followed by 24.10 cm in T<sub>12</sub> and the minimum germination of seed was observed in treatment T<sub>1</sub>(23.24).

Plant height of treatment T<sub>11</sub> were observed with mean maximum plant height (83.13cm) followed by 80.02 cm in T<sub>8</sub> and the minimum plant height was observed in treatment T<sub>1</sub>(61.17cm). The resulting in better availability and nutrient uptake by the plants which in turn helped in producing better growth. These results regarding, the plant height were well-supported by Similar results are obtained by Pandey et al.,[5], Younis et al., [6] and Kumar and Saravanan [7].

The highest grand mean of the stem girth of the treatment T<sub>11</sub> plant was 24.25 cm and minimum stem girth of the treatment was found the control (18.45 cm). Presence of macro and micro nutrients also are of key importance because of its catalytic and stimulatory affecting various metabolic and physiological processes of the plant. Similar data was also observed by Vikas et al. [8] in dahlia and Yadav et al. (2007) in chrysanthemum cultivars.

The maximum number of secondary branches per plant i.e., 9.02 was recorded in treatment T<sub>11</sub> followed by T<sub>12</sub> (8.15) were at par with each other, whereas minimum number of secondary branches were observed with control i.e. treatment T<sub>1</sub> (2.53). In the present study, it was observed that due to the minimum availability of macro nutrients in control treatment resulted in minimum branch production. These results are in the conformity with the findings of Ahmed et al., [9], Younis et al., [6] and Singh et al., (1996).

The maximum number of leaves were recorded in the treatment T<sub>11</sub> (150.78) whereas minimum number of leaves were recorded in the Treatment control (60.33) which was statistically significant. Similar variations in number of leaves were also reported by Singh and Mishra [10] found in Tuberose and Damke et al. [11] found in chrysanthemum.

The data pertaining to leaf area revealed that the highest grand mean of the treatment was 82.88 cm<sup>2</sup> and the lowest value found of leaf area of the treatment 64.50 cm<sup>2</sup>. Similar variations in the leaf area were also observed by Shruti et al. [12] and Anop et al. [13] in gerbera.

The minimum number of days taken to first bud appearance (80.73days) was recorded under treatment control which was supplemented with Biovita followed by treatment T<sub>2</sub> (69.06 days), which were at par with each other. The maximum time to appearance of first bud (82.88 days) was recorded with treatment T<sub>11</sub>. The earliness in first bud appearance by the use of plant growth regulators in combination may be due to the availability of proper nutrients to the plants. As a result, plants completed their vegetative growth earlier resulted in taking the smaller number of days for bud appearance. While in other treatments only organic fertilizer is applied in which macronutrients are available in lesser quantities comparatively and here, the nutrients take more time to be available to the plants. These findings are similar to the Kumar and Saravanan [7], Kumar [14] and Meena et al., [15].

**Table 2. Vegetative growth parameters in dahlia plant of various plant growth regulators**

Treatments	Days taken for germination of seeds	Plant Height (cm)	Stem girth(cm)	Number of secondary branches	Number of leaves per plant	Leaf Area	Days taken for floral bud formation
Control	23.24	61.17	18.45	2.53	123.76	64.50	80.73
2 ml L <sup>-1</sup> Kelp, 5 days interval	23.76	66.23	22.66	6.52	128.91	77.77	91.53
2 ml L <sup>-1</sup> Kelp, 10 days interval	23.33	64.11	20.11	5.78	126.73	73.76	88.00
2 ml L <sup>-1</sup> Kelp, 15 days interval	22.77	63.13	19.35	4.58	124.27	69.12	82.07
4 ml L <sup>-1</sup> Kelp, 5 days interval	23.90	74.12	23.08	7.11	135.65	78.97	94.20
4 ml L <sup>-1</sup> Kelp, 10 days interval	23.37	72.67	20.21	6.03	130.14	75.86	86.47
4 ml L <sup>-1</sup> Kelp, 15 days interval	22.71	69.15	19.52	5.67	125.89	70.48	82.87
2 ml L <sup>-1</sup> Biovita, 5 days interval	24.32	80.03	24.20	8.23	141.28	78.97	96.20
2 ml L <sup>-1</sup> Biovita, 10 days interval	23.47	70.23	20.43	6.95	137.70	77.31	88.47
2 ml L <sup>-1</sup> Biovita, 15 days interval	23.33	69.09	19.17	6.04	128.10	69.06	84.33
4 ml L <sup>-1</sup> Biovita, 5 days interval	24.57	83.13	24.25	9.02	150.78	82.88	97.13
4 ml L <sup>-1</sup> Biovita, 10 days interval	24.10	80.20	21.63	8.15	141.64	77.58	90.26
4 ml L <sup>-1</sup> Biovita, 15 days interval	23.87	79.45	19.94	7.04	136.17	71.87	88.67
F test	S	F	S	S	S	S	S
Sem	0.14	1.58	0.53	0.43	1.66	1.39	25.08
C D At 5 %	0.09	1.02	0.35	0.28	1.08	0.91	16.30
CV	2.08	7.92	9.12	24.06	4.62	6.75	5.90

**Table 3. Flowering growth parameters in dahlia plant of various plant growth regulators**

Treatments	Flower Diameter	Duration of flowering (days)	Vase life (days)	No. of flowers plant <sup>-1</sup>	Flower yield /plant (g)	Flower yield/ha (t)
Control	9.95	79.17	4.13	74.11	213.65	8.50
2 ml L <sup>-1</sup> Kelp, 5 days interval	10.78	93.17	5.18	82.53	299.08	12.78
2 ml L <sup>-1</sup> Kelp, 10 days interval	10.55	86.43	4.52	77.67	262.45	10.45
2 ml L <sup>-1</sup> Kelp, 15 days interval	10.08	80.89	4.23	74.76	252.92	9.70
4 ml L <sup>-1</sup> Kelp, 5 days interval	10.9	93.6	5.23	82.86	344.73	13.35
4 ml L <sup>-1</sup> Kelp, 10 days interval	10.63	86.7	5.02	77.57	323.13	11.38
4 ml L <sup>-1</sup> Kelp, 15 days interval	10.11	78.93	4.65	75.24	289.14	11.09
2 ml L <sup>-1</sup> Biovita, 5 days interval	11.06	94.3	5.4	84.71	361.87	16.93
2 ml L <sup>-1</sup> Biovita, 10 days interval	10.77	84.7	5.02	78.29	298.76	14.35
2 ml L <sup>-1</sup> Biovita, 15 days interval	10.09	80.52	4.67	75.63	272.58	12.69
4 ml L <sup>-1</sup> Biovita, 5 days interval	11.78	96.42	5.79	84.9	418.72	16.25
4 ml L <sup>-1</sup> Biovita, 10 days interval	11.06	89.82	5.04	79.43	372.12	15.23
4 ml L <sup>-1</sup> Biovita, 15 days interval	10.45	81.87	4.79	76.27	305.34	13.89
F test	S	S	S	S	F	F
Sem	0.11	1.69	0.12	1.04	25.08	0.92
C D At 5 %	0.07	1.1	0.08	0.68	16.30	0.60
CV	3.77	7.02	8.81	4.77	15.10	19.70

**Table 4. Economics of dahlia plant of various plant growth regulators**

Treatments	Cost of cultivation (Rs/ha)	Total yield (t/ha)	Selling Rate (Rs/q)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit-cost ratio
T1	170500	8.5	4000	340000	169500	0.99
T2	170500	12.78	4000	511200	340700	2.00
T3	170500	10.45	4000	418000	247500	1.45
T4	170500	9.7	4000	388000	217500	1.28
T5	170500	13.35	4000	534000	363500	2.13
T6	170500	11.38	4000	455200	284700	1.67
T7	170500	11.09	4000	443600	273100	1.60
T8	170500	16.93	4000	677200	506700	2.97
T9	170500	14.35	4000	574000	403500	2.37
T10	170500	12.69	4000	507600	337100	1.98
T11	170500	16.25	4000	650000	479500	2.81
T12	170500	15.23	4000	609200	438700	2.57
T13	170500	13.89	4000	555600	385100	2.26

### 3.2 Flowering Growth Parameters in Dahlia Plant of Various Plant Growth Regulators

The largest flower diameter (11.78 cm) was recorded under treatment T<sub>11</sub> which was supplemented with biovita followed by treatment T<sub>12</sub> (11.06 cm), which were at par with each other whereas smallest flowers (9.95 cm) were noticed with treatment T<sub>1</sub> (control). Kumar and Saravanan [7] found the increase in flower diameter due to the solubilizing effect on the fixed form of the nutrients increasing the flower diameter and stimulating and enhancing the flower size. Cell division, cell enlargement and availability of metabolites as amino acids, proteins and nucleoproteins led to increase in flower diameter.

The flower duration ranged from 79.17 (T<sub>1</sub>) to 96.42 (T<sub>11</sub>) days. Plant growth regulators supplemented had presented the longest duration of flowering. This may be attributed to the reason that flowering duration potential of dahlia is under control of its genetic makeup rather than any cultural practice. These results are in line with the findings of Farhad et al. [16].

Among the treatments, treatment T<sub>11</sub> (Biovita) was found most effective in reporting the maximum vase life (5.79 days). However, minimum vase life (4.13 days) was reported under the treatment T<sub>1</sub> (control).

The analysis of data, on number of flowers per plant clearly indicated that the maximum number of flowers (84.71/plant) were observed from the treatment T<sub>11</sub> (Biovita) which was significantly

superior over all other treatments. It was followed by treatment T<sub>8</sub> (84.71). The minimum flower number was recorded under control (74.11/plant). Similar results are reported by Ahmed et al. [9], Khasa et al., [17] and Carlile [18].

The yield flower per plants of treatment T<sub>11</sub>, with Biovita were observed with mean maximum weight of flowers/plant (418.72 g) which was observed statistically significant from T<sub>1</sub> (control) and minimum flowers yield in all the treatment was found in control (213.65 g). Weight of flowers/plant was significantly increased with the combined application [19,20].

The flower yield per tonne of treatment T<sub>11</sub>, with Biovita were observed with mean maximum weight of flowers/plant (16.26 t) which was observed statistically significant from T<sub>1</sub> (control) and minimum flowers yield in all the treatment was found in control (8.50 t). Weight of flowers/plant was significantly increased with the combined application. This could be due to the maintenance of proper supply of all the essential nutrients at scheduled timing. This integration shows a positive effect on the growth of various flower crops and also increases the soil fertility status. These findings are in the conformity to the results of Kumar and Chaudhary [4].

### 3.3 Economics of Dahlia Plant of Various Plant Growth Regulators

The data presented in table depicts the B:C ratio in response to the application of applied plant growth regulators. The B:C ratio is

found to be 1:2.81 in response to treatment T<sub>11</sub>, indicating that after spending 1 rupee, one can earn profit of 2.81 rupee. For treatment T<sub>1</sub>, the B:C ratio was least i.e. 0.99, signifying that for 1 rupee spent, one can earn profit of Rs. 0.99. The Cost of production (Rs/ ha) 17500 Rs. Maximum gross return were found in treatment T<sub>11</sub> and also found net return.

#### 4. CONCLUSION

Seaweed extract had a significant effect on the growth, flowering yield and quality of branch, number of leaves and stem diameter and other floral parameter and estimate the economics of the various treatments. The highest growth and floral quality parameter was found in the treatment T<sub>11</sub>, (4 ml L-1Biovita, 5 days interval) and also found highest cost benefit is 2.97.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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