

## The Impact of (Alga Mix) Seaweed and Garlic Extraction on Growth and Yield of Cauliflower

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### Abstract

Seaweed and plants extracts can be applied as biostimulants during vegetable improvement owing to their improvement effects on plant growth, so this study was conducted in Horticulture Department, University of Sulaimani, Kurdistan region-Iraq to investigate the influence of different treatments such as Sea weed (Alga Mix) with (0, 5 and 10 ml.l<sup>-1</sup>) and Garlic extraction at levels (0, 10% and 20%) V/V on growth and yield of cauliflower. Effect of Alga Mix with (10 ml<sup>-1</sup>) significantly increased in vegetative growth characteristics; included plant height (47.14 cm), stem diameter (21.18 mm). Also, using garlic extraction with (20%) V/V significantly enhanced plant height (45.65 cm), Number of (34.11 leaf.plant<sup>-1</sup>), stem diameter (21.31 mm), plant fresh weight (2030.33 g), curd fresh weight (g.plant<sup>-1</sup>) (613.0 g.plant<sup>-1</sup>) root weight (121.00 g.plant<sup>-1</sup>). From these results, it could be recommended that Alga Mix and Garlic extraction individually or in combination are important for improving the cauliflower growth and productivity.

Key Words: Cauliflower, Alga Mix, Garlic Extracts

### INTRODUCTION

Cauliflower (*Brassica oleracea* L.) belongs to the family Brassicaceae family, is one of the most also popular and widely grown vegetables. It is also called 'Cole crop' vegetables. It is very well known for its nutritive value. This vegetable is biennial plant that reproduces by seed. Typically, only the compacted immature flowers (the white curd) of aborted floral meristems are eaten, while the stalk and surrounding thick, green leaves are used for many purposes or discarded [1]. This vegetable has low content of fat but high in dietary fiber, folate, water, vitamin-C and possessing a high nutritional density [2]. Additionally,

several phytochemicals are observed in this vegetable that may be beneficial to human health [3].

Foliar nourishment guarantees the availability of nutrients and hormones to crops so that the higher yield can be obtained [4][5]. Recent studies emphasized on the natural seaweeds are being used as substitute of synthetic fertilizer. Extractions of seaweed are marketed as liquid fertilizers and bio-stimulants because they contain multiple growth regulators such as cytokinins [6][7], auxins [8], gibberellins [9] and also contain a macro and micronutrients necessary for plant growth and development. The beneficial effect of

seaweed extract application is as a result of many components that may work synergistically, although the mode of action still remains unknown [10]. [11] reported that seaweed extracts have gained in popularity due to their potential use in organic and sustainable agriculture. The use of products based on seaweeds is becoming more common in vegetables production. Many studies are investigated the influence of seaweed extracts on the yield, also on some quality parameters which important for consumers. [12] mentioned that Alga Mix increased the lettuce yield. While [13] Investigated that foliar application of seaweed extract interaction with Gibberellins increased curd head, number of leaves, stem diameter, weight plant and marketable yield in cauliflower. [14] mentioned that Biohealth (seaweed extract with humic acid) increased the growth and yield in lettuce.

Concerning garlic acid effect, [15] reported that application of fresh garlic clove extract to as a foliar application with 250 mg DW.plant<sup>-1</sup> on summer squash cv. Eskandarani has been achieved the best results in number of flowers. [16] found that a best value in the number of pods of pea (cv. Meteor) had been obtained with foliar garlic extracts at 10 g.l<sup>-1</sup>.

Alga Mix is a liquid concentrated based on natural extract of seaweed and enriched with molybdenum, prepared for its application via foliar. Due to its content in seaweed extract, provides the plant with big quantity of natural phytohormones (cytokinins, auxins, gibberellins...), amino acids and carbohydrates (alginic acid, mannitol, laminarin...) and therefore, once applied, comes into the cellular tissues acting in the physiologic process of the plant. Stimulating the

growth and the development of the plant.

### **The aim of this study**

The aim of this study is to increase cauliflower yield without using chemical fertilizers and using those organic fertilizers which have the same effect in increasing the yield compare to other traditional chemical fertilizers. For this reason, these two effective organic fertilizers Alga Mix and Garlic extract had been chosen in this study to investigate their influences on growth and yield of cauliflower.

### **Materials and methods**

#### **Executing the experiment and initializing the field**

This research was conducted under greenhouse at Horticulture Department, College of Agricultural Engineering Sciences, University of Sulaimani, Kurdistan region-Iraq to study effects of (Alga Mix) seaweed and Garlic Extraction on growth and yield of Cauliflower plant. Some physical and chemical properties of the soil under the experimental plots during the study period were shown in table (1). Seeds were sown in 1/9/2019 to produce seedlings, the seedlings were transferred into the greenhouse, with ten plants per experimental unit planted. The distance between the plants were 40 cm while the distance between lines were 75 cm. Drip irrigation system has been used for irrigation. The experiment was conducted based on Complete Randomized Design (CRD) with (3) replicates to study the effect of two factors. The first factor is seaweed (Alga Mix) extract at three levels (0, 5 and 10 ml.l<sup>-1</sup>) symbolized as A0, A1 and A2, second factor was garlic extract at three levels (0, 10% and 20%) symbolized as B0, B1 and B2, the experiment included 9 treatments (3\*3). The foliar applied three times

(after 20 days of transplanting, 20 days after the first application, and 20 days after the second application).

### Study Parameters and statistical analysis

The study parameters are Plant height (cm), Number of leaves (leaf.plant<sup>-1</sup>), Stem diameter (mm), Plant fresh weight (g), Curd fresh weight (g.plant<sup>-1</sup>), Curd diameter (cm), Root weight (g), the experiment was designed as a randomized complete block design (RCBD). The collected data were statistically analyzed using XLSTAT software version 2019. All means were tested by Duncan multiple range test at 5% level of probability.

## RESULTS & DISCUSSION

### 1. Plant height (cm)

The results indicated that their significant differences in plant height. The cauliflower plants attained maximum height (47.14 cm) at seaweed level of 5ml.l<sup>-1</sup>, followed by (44.24 cm) seaweed at the level of 10ml.l<sup>-1</sup>. While Garlic extract 20% gave (45.65 cm) as best results, followed by Garlic extract 10% (44.49). However, the shortest plants (38.21 and 39.22 cm) were recorded in control, the best results in interaction treatment were (A1B1) which recorded (51.16 cm).

### 2. Number of leaves (leaf. plant<sup>-1</sup>)

Table (2) showed that the maximum number of leaves (27.11 leaf.plant<sup>-1</sup>) produced by A2(10ml.l<sup>-1</sup>) and the minimum (18.22 leaf.plant<sup>-1</sup>) was produced by the A0 control. The highest number of leaves (34.11 leaf.plant<sup>-1</sup>) was obtained from B2(20%) showing significantly different result from other treatments while B0 gave minimum leaf number (19.33 leaf.plant<sup>-1</sup>).

### 3. Stem diameter (mm)

Table (2) shows that stem diameter was not significantly affected by seaweed and Garlic extracts.

### 4. Plant fresh weight (g)

Table (2) explained that the effect of the main treatments and their interactions were significant for fresh plant weight. Seaweed 10ml.l<sup>-1</sup> recorded maximum data (2282.09g plant<sup>-1</sup>) followed by Seaweed 5ml.l<sup>-1</sup> (2011.66 g.plant<sup>-1</sup>) with no significant differences between them, while minimum plant weight obtained from control (858.27 g.plant<sup>-1</sup>). It showed that there were no significant differences between garlic extract treatments. Also, showed that plant weight was affected by combination of seaweed and garlic extracts. The highest plant weight was (2929.33 g.plant<sup>-1</sup>) obtained from (A2B2). [17] explained that these affect a photosynthesis, respiration, cell metabolism, and nucleic acid synthesis, thereby increasing cell division, protein synthesis, enzymes, and hormones, thus increasing growth properties of plants.

### 5. Curd fresh weight (g.plant<sup>-1</sup>)

Table (2) showed that alga Mix affected on curd fresh weight, the highest (681.0 g) was obtained in A2 (10ml.l<sup>-1</sup>) and the lowest (447.0 g) was gained from A0 (0ml.l<sup>-1</sup>) while there are no significant differences between garlic extracts treatments. it may due to marine extract which contains organic acids, auxins, cytokines, gibberellin, amino acids, and certain mineral elements. [18] demonstrated that the reason for the superiority of spray with marine algae extracts and Prosol solution may be due to the role of nutrients included in their structure and its positive effect on the process of photosynthesis which is represented by increasing leaf area and the number of

leaves per plant. This led to an increase in the manufacture of carbohydrates in leaves. The products of processed materials then moved from photosynthesis to their storage locations causing increase curd weight and diameter, thus increasing the total yield.

In combination, the highest (729.0 g) and the lowest (344 g) curd weight was observed in A2B1 and A0B0, respectively.

## 6. Curd diameter (cm)

The main effect of seaweed was significant on increasing cauliflower curd diameter. The maximum curd diameter (14.44 cm) was recorded at A2 (10ml.l<sup>-1</sup>). There was significant ( $p < 0.05$ ) interaction effects of seaweed and garlic extract on increasing d curd diameter. The maximum curd diameter (16.67 cm) was recorded at A2B0 followed by A2B1 (14.40 cm) which was significantly higher than those recorded at control. There were no significant differences between garlic treatments (Table 2).

## 7. Root weight (g)

Results in table (2) indicted that there a significant effect of fresh root weight. Seaweed (10 ml.l<sup>-1</sup>) recorded maximum data (198.66 g.plant<sup>-1</sup>) followed by Seaweed (5ml.l<sup>-1</sup>), (83.65

g.plant<sup>-1</sup>), while minimum value obtained in control (59.86 g.plant<sup>-1</sup>). It also explained no significant differences between garlic extract treatments. It showed that root weight was affected by combination of seaweed and garlic extracts, the highest value was (199.43 g.plant<sup>-1</sup>) with treatment (A2B2) and the lowest value was (33.95) in (A0B0). This effect might be due to presence of several cytokinin that are found in brown algal extracts, including, trans-zeatin riboside, and their dihydro derivatives [18]. Also, reported that the bioactive compounds present in *Ascophyllum nodosum* extract and its organic subfractions have affected the legume-rhizobia signaling processes, resulting in more functional nodules and overall improvement in growth of alfalfa plants [19].

## CONCLUSIONS AND RECOMENDATIONS

Seaweed and garlic extracts are very effective to improve the vegetative growth and yield of cauliflower. Different concentrations of both extracts can stimulate the growth and yield of cauliflower. For reaching consistent results it has been recommended to replicate the current study with different environmental conditions, or testing different types of plant extracts to get the best results.

**Table (1) The main physical and chemical properties of the experiment location soil.**

Soil properties*	Units	The Values
Sand	g.kg <sup>-1</sup>	435.70
Silt		244.50
Clay		319.80
Texture		Sandy clay loam
EC	d.ms <sup>-1</sup>	1.03
pH		7.87
Organic matter	g.kg <sup>-1</sup>	28.90
Total nitrogen		10.20
Available phosphorus		0.03
Soluble potassium		0.08

\*Data were analyzed in the Central Laboratories of College of Agricultural Sciences Engineering, University of Sulaimani.

**Table (2) Effect of Alga Mix, Garlic extract and their interactions on vegetable growth and yield characteristics.**

Treatments		Characteristics						
		Plant height (cm)	No. of leaves (leaf. plant <sup>-1</sup> )	Stem diameter (cm)	Plant fresh weight (g)	Curd fresh weight (g. plant <sup>-1</sup> )	Curd diameter (cm)	Root weight. plant <sup>-1</sup> (g)
A0 (0ml.l <sup>-1</sup> )	B0(0%)	30.21d	13.00b	15.91a	672.53b	344.0e	8.70c	33.95d
	B1(10%)	38.17c	18.00b	21.20a	865.30b	471.0d	8.00c	62.43d
	B2(20%)	46.22b	23.66ab	23.40a	1037.00b	522.0c	11.00b	83.21c
A1 (5ml.l <sup>-1</sup> )	B0(0%)	44.76b	22.55ab	21.00a	1547.40ab	493.0cd	9.87c	73.37bc
	B1(10%)	51.16a	27.33ab	21.43a	2261.80b	486.0d	11.77b	83.43b
	B2(20%)	40.77bc	22.66ab	21.12a	2225.80ab	717.0a	13.57ab	94.17ab
A2 (10ml.l <sup>-1</sup> )	B0(0%)	47.97b	25.43ab	19.54a	1970.55ab	714.0a	16.67a	78.10bc
	B1(10%)	49.87a	28.90a	20.77a	2047.37ab	729.0a	14.40a	108.45ab
	B2(20%)	50.00a	30.38a	23.43a	2929.33a	600.0b	12.77b	199.43a
Mean AlgaMix Seaweed	A0(0ml.l <sup>-1</sup> )	38.21b	18.22b	20.17a	858.27b	447.0b	9.23c	59.86c
	A1(10ml.l <sup>-1</sup> )	47.14a	26.77a	21.18a	2011.66a	465.0b	11.7b	83.65b
	A2(20ml.l <sup>-1</sup> )	44.24ab	27.11a	19.90a	2282.08a	681.0a	14.44a	198.66a
Mean Garlic Extract	B0(0%)	39.22b	19.33b	19.81a	1396.86a	518.0a	11.75a	57.81c
	B1(10%)	44.69a	24.66b	21.13a	1724.82a	562.0a	12.12a	81.43b
	B2(20%)	45.65a	34.11a	21.31a	2030.33a	613.0a	11.78a	121.00a

Values with different letters indicate significant differences at  $P < 0.05$  according to the Duncan multiple range test.

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