Angewandten Biologie Forschung
www.ctbscience
ISSN: 2321-1733

Response of growth and yield of *Ocimum basilicum* with application of Humic acid

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Abstract

The present investigation was carried out to evaluate the effect of humic acid fertilizer on growth and yield of Basil (Ocimum basilicum.) in open field. Humic acid was used in five levels (0, 2.5, 5, 10 and 15 gr/lit for $0.5m^2$) which were used in fertigation. Humic acid application was performed five times during the growth period. Measured factors consisted of total weight, shoot weight, plant height, root Length , Inter node Length, Lateral shoot Length, shoot number, Leaf number, Dry weight leaf, node number, fresh weight leaf, leaf area, total biomass, diameter root, essential, chlorophyll and antioxidant activity. The results of this study showed that application of humic acid on growth and yield parameters was effective. Application of humic acid with concentration H_4 (15g/l for 0.5m) have the best of growth and yield but was observed the highest of height of plant in H_2 (5g/ l for 0.5m). But, no significant differences were found between humic acid and control in essential oil, chlorophyll and antioxidant activity.

Key words: Ocimum basilicum, humic acid, yield, growth

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1.0 Introduction

Partial of natural organic material in soils, waters and sediments are humic substances which they have complex chemical structures and more stable than their precursors and have lost their chemical characteristics [1]. Organic substances used for fertile soil are variety such as manure, compost also humic acid [2]. Sharif et al. [3] stated application of humic acid can be promising for increasing crop production. The effects of humic acid consist of reduction of fertilizer requirements, increases yield in crops, aeration of the soil, improved drainage [4] increase plant growth [5]the mechanism of increasing growth in response to humic acid consisted of improving of nutrition absorption [6]and plant metabolism [7] humic substances increased dry matter yields of corn and oat seedlings [8,9]and numbers and lengths of tobacco roots [10]. The aim of this investigation is evaluation of application of humic acid on growth and yield of Ocimum basilicum.

2.0 Material and Methods

Plant preparation

The field trial was conducted during the 2010 growing season at the experimental field of the Agricultural Faculty, University of Ferdowsi, Mashhad (latitude 36.305° N, longitude 59.599° E and elevation), Iran. The seeds were planted in rows 20 cm apart with an intra-row spacing of 15 cm.

Treatments

Plants were exposed to 0, 2.5, 5, 10, and 15 g /0.5 m2 HA. HA application was performed five times during the growth period. Standard cultural practices were applied homogeneously through all plots. Harvesting was performed 30 days after the planting.

Measurements

Immediately after harvest, three plants in each replication were used for measurement of factors. Measured factors consisted of total weight, Branch weight, plant height, root Length , Inter node Length, Lateral branch Length, Branch number, Leaf number, Dry weight leaf, node number, fresh weight leaf, leaf area, total biomass, diameter root, essential, chlorophyll and antioxidant activity.

Determination of antioxidant activity

Determination of antioxidant activity was done by 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity [11]. To 3.9 mL methanolic DPPH solution (0.004%, w/v), 0.1 mL of methanolic extract at various concentrations was added, mixed thoroughly and left in a dark place. After 30 min the absorbance was read at 517 nm against control without the extract. DPPH radical scavenging activity was obtained with the following equation:

Radical scavenging activity (%) = $(A_0 - A)/A_0 \times 100$

A_0 is control absorbance and A is sample absorbance.

Chlorophyll Measurement

Leaf chlorophyll content was measured by a portable chlorophyll meter, SPAD-502 (Minolta Corporation, Ramsey, NJ).

Experimental design and statistical analysis

The experiment was set up according to a randomized complete block design with four replications. Data were analyzed using SAS and means were compared by Duncan's multiple range test (DMRT) at 5% level of confidence.

3.0 Results and Discussion

According to results of this investigation that has been shown in Table-1 and Table-2 ($p \leq 0.05$) application of humic acid with concentration H_4 (15g/l for 0.5m) have the best of growth and yield but was observed the highest of height of plant in H_2 (5g/ l for 0.5m). The lowest of growth and yield traits was related to control therefore application

of humic acid had positive effect on growth accordingly yield of basil. According to results of this investigation application of this organic fertilizer had no significantly effect on chlorophyll, essential and antioxidant.

Atiyeh et al [12]stated HA treatment at different concentrations significantly improved tomato yield. Yildirm [13] in two-year experiment showed leaf dry matter content increased with application of humic. Canellas et al. [14]stated cause of increasing in elongation and lateral emergence of root and plasma membrane H^+-ATPase activity of maize roots are presence exchangeable auxin groups in humic acids. These studies are agreement with our study.

Height of plant can be considered as one of the indices of plant vigor ordinarily and it depends upon vigour and growth habit of the plant. Soil nutrients are also very important for the height of plants [15] also in this study humic acid fertilizer application increased plant height. Ameri and Tehranifar, [16] reported application of humic acid had no significantly effect on chlorophyll in strawberry that it is agreement with this study. Humic acid improves crop yield and quality in a variety of plants, including fruits [17, 18], and vegetables [19, 20]. Humic acid (HA) might benefit plant growth by improving nutrient uptake and hormonal effects. Our results are in accordance with the results obtained from another study carried out by Nikbakht et al [21].

4.0 Conclusion

Results obtained from application of humic acid on basil suggested a better state of most growth and yield however using humic acid had no significantly effect on essential oil, antioxidant and chlorophyll content in this field experiment but cannot be stated it isn't effective on them and final conclusion can only be obtained by using other concentrations and other ways of fertilization.

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Treatment	Total weight (g)	Shoot weight (g)	Plant height (cm)	Root Length (cm)	Inter node length (cm)	Lateral shoot Length (cm)	Shoot number	Leaf number	Antioxidant
Control	3.39^{d}	3.18^{d}	15.17^{d}	7.71^{b}	3.66^{b}	0.22^{b}	2.75^{c}	17.75^{c}	81.68^{a}
H_1	7.78^{c}	7.28^{c}	28.12^{c}	7.62^{b}	6.16^{a}	3.99^{a}	5.67^{b}	34.83^{b}	82.69^{a}
H_2	12.18^{b}	11.38^{b}	34.83^{a}	9.54^{a}	6.80^{a}	4.28^{a}	7.00^{ab}	46.42^{a}	82.33^{a}
H_3	12.49^{b}	11.36^{b}	30.73^{bc}	10.00^{a}	6.44^{a}	4.28^{a}	7.50^{a}	41.83^{ab}	82.05^{a}
H_4	15.00^{a}	13.56^{a}	32.96^{ab}	10.75^{a}	6.84^{a}	6.07^{a}	7.42^{a}	49.17^{a}	81.54^{a}

Within each column, same letter indicates no significant difference between treatments at 5% levels.
HA_1=2.5, HA_2=5, HA_3=10 and HA_4=15 gr/lit for 0.5m^2

Table -1: Effect of Humic acid on studied traits

Treatment	Dry weight leaf (g)	Node Number	Fresh weight leaf (g)	Leaf Area (cm^2)	Total Biomass (g)	Diameter root (mm)	Essential oil	Chlorophyll
control	0.04^{c}	5.50^{c}	0.24^{d}	12.12^{b}	0.66^{b}	0.35^{b}	0.07^{a}	48.92^{a}
H_1	0.04^{c}	7.42^{b}	0.33^{c}	19.65^{a}	0.58^{b}	0.35^{b}	0.08 ^{a}	50.50 ^{a}
H_2	0.05^{b}	8.50^{a}	0.45^{b}	22.39^{a}	0.62^{b}	0.45^{ab}	0.07 ^{a}	47.95 ^{a}
H_3	0.05^{b}	7.58^{b}	0.46^{b}	24.87^{a}	1.79^{a}	0.42^{ab}	0.07^{a}	48.07 ^{a}
H_4	0.06^{a}	8.75^{a}	0.52^{a}	23.22^{a}	1.58^{a}	0.51^{a}	0.07^{a}	48.92^{a}

Different letters in each column indicate significant difference between treatments at 5% levels
HA_1=2.5, HA_2=5, HA_3=10 and HA_4=15 gr/lit for 0.5m^2

Table-2:Effect of humic acid on studied traits