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# Effects of nano zinc and humic acid on quantitative and qualitative characteristics of savory (*Satureja hortensis* L.)

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**Key words:** Nano fertilizer, Zinc, Humic acid, Savory.

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## Abstract

In the research greenhouse of the Institute of, University of zabol, Iran). a factorial experiment was condition in the form of completely randomized design (CRD) on four replications. The treatments were humic acid concentrations in four levels (0, 0.5, 1, and 1.5 on each one 1000 m/liters water) and nano ze chelated fertilizer in four levels (0, 50, 100, and 200 mg; on each one at 1000 m/liters per water) Results of variance analysis showed that the interaction effect of humic acid × nano ze chelated fertilizer and the effect of humic acid and nano ze chelated fertilizer management on Plant height, Leaf fresh and dry weight, Phosphorus,Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil content was significant at 1% probability level. minimum plant height, Leaf fresh and dry weight, Phosphorus,Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil content of the treatment control and maximum plant height, Leaf fresh and dry weight, Phosphorus, Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil content of treatment were gained in $N_4$. maximum, Leaf fresh and dry weight, Phosphorus, Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil were gained from $H_4$ fertilizer treatment Except plant height that maximum, plant height was obtained $H_3$ fertilizer treatment. maximum plant height, Leaf fresh and dry weight, Phosphorus, Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil content of treatment were obtained in $N_4H_4$.

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## Introduction

Production of medicinal plants is mainly under the circumstances of sustainable agricultural system.In this system, management of environmental parameters is very critical. By using correct nutritional sources through humic acid, nano zn chelated fertilizers quantitative and qualitative yield of medicinal plants can be maximized.aim of In this study the effect of nano ze chelated fertilizer and humic acid on growth parameters and Essential oil content were investigated. The genus Satureja *(*Labiatae family*)* comprises over 30 species with wide distribution in the Mediterranean region (Hadian *et al*, 2008). And impetus for further attempts to search for new Among them, many are used as valuable medicinal and spice plants worldwide. S. hortensis L. (savory) is an annual aromatic plant with linear to linear-oblanceolate leaves and white to pale red flowers, which are born in erect stems (Rechinger, 1982). In folk medicine, Satureja hortensis is used as stomachic, stimulant, carminative, expectorant,the world aphrodisiac, antispasmodic and antidiarrheals (Hajhashemi, 2000; Skocibusic *et al*., 2006). In addition, savory has wide application in food, drink and perfume industries (Sefidkon *et al*.,2006; Skocibusic *et al*., 2006). The essential oil of S. hortensis possesses many activities such as antioxidant, antibacterial and antifungal (Gulluce *et al*.,2003; Rezaeei *et al.,* 2014). The main essential oil constituents are phenolic compounds including carvacrol and thymol, as well as γ-terpinene, p-cymene, β-caryophyllene, linalool and other terpenoids (Rechinger,1982; Zawislak, 2008). Besides, adaptability to harsh environmental conditions, high yield and short growing period make S. hortensis as a valuable alternative crop in agriculture (Hadian *et al.,* 2008). In the recent years, the interest of growing herbs such as savory as alternative crops are highly increased (Prohens *et al.,* 2003). Humic substances have a very profound influence on the growth of plant roots. When humic acids and fulvic acids are applied to the soil, enhancement of root initiation and increased root growth wasobserved (Pettit*,* 2004). Humic substances may possibly enhance the uptake of minerals through the stimulation of microbiological activity (Mayhew*,* 2004). When adequate humic substances are present within the soil, the requirement for nitrogen, phosphorus and potassium fertilizer applications may be reduced (Mayhew*,* 2004). Humic acid (HA) and phosphorus applications increased the growth and growth parameter of pepper seedling. The combined effects of HA and P application was more effective on growth and growth parameter than each separate effect. Humic acid is a commercial product contains many elements which improve the soil fertility and increasing.the availability of nutrient elements and consequently affected plant growth and yield. Humic acid particularly is used to remove or decrease the negative effects of chemical fertilizers and some chemicals from the soil major effect of humic acid on plant growth has long beenreported (David *et al.,*1994; Hartwigson and Evans, 2000; Lee and Bartlett,1976; Linchan, 1978). There is basic agreement on the benefits of humus, but there is quite a controversy on the benefit of application of applied humate (the deposits containing the humic acids) (Nguyen and Niemeyer*,* 2008). Khalily mahhaleh *et al.,* (2002) indicated that foliar application of micro elements such as iron, zinc, manganese in both shooting and a little before the flowering stages increased the yield and yield components of corn cilage. The main difference between nano technology and other technologies is in material and structures which are used in this technology. Nono powders are mixture of particles with dimensions between 1 to 10 nm. One of the most important applications of nanotechnology in agriculture and trends in water and soil science is using nano fertilizers for plant nutrition (Rezaeeia *et al.,* 2014). Seven elements of available nutrients in natural environment have low necessity for plant growth. Some of them are absorbed in cation form such as iron, manganese, copper and zinc and some of them are absorbed in inione form such as bor, molybdenum and chlorine (Khajepoor, 1998).

Bozorgy *et al.,* (2011) indicated in there that by increasing the zinc spraying, harvest index in bean plant increased. Nazari (2012) reported that methanol and nano iron chelate fertilizer spraying on *Ocimum basilicum* L. could be increased carbon dioxide assimilation and leaf stomata conductance and maximum biomass was achieved at 20% methanol and 1g 1-1nano iron chelate fertilizer. Zn is a vital element for wheat growth and it activates some enzymes such as carbonic anhydrase, dehydrogenase, proteinase and peptidase (Marshner, 1986). Many experiments have been established to identify the effects of Zinc on wheat improvement and its necessity for important yield quality. (Malakouti, 2000; Malakouti and Agha lotfolahi, 1999; Shankar and Mehrotra, 1987; Amin *et al.*, 1989; Chibba *et al.*, 1989; Bansal *et al.,* 1990; Bernan,1992; Miah *et al.,* 1992; Sharma and Lal, 1993; Gill *et al.,* 1994). Chipa and Lal (1986) reported that use of extra application of Zn is necessary to avoid decreasing of low uptakes of micronutrient caused by salinity. It has been suggested that use of Zn in saline condition led to increase in root and shoot growth and improved salinity hazards on root and shoot structure.Hemantaranjan and Gray (1988) indicated that using Zn led to increases in leaf chlorophyll and indol acetic acid, so photosynthesis will be improved and then dry mater will be increased.

Generally, a balanced supply of nutrients is essential for optimum yield and fruit quality (Akhtar *et al.*, 2010). Foliar spraying is a new method for crop feeding which micro and macro nutrients in form of liquid is used into leaves (Nasiri *et al.*, 2010). Humic acid (HA) is a promising natural resource that can be used as an alternative to synthetic fertilizers to increase crop production. It exerts either a direct effect, such as on enzymatic activities and membrane permeability, or an indirect effect, mainly by changing the soil structure (Biondi *et al.*, 1994). Humic acid application, berry weight, titratable acidity and maturity index values of Italy grape cultivar increased significantly in the full bloom period(Ferrara and Brunetti, 2010). Albayrak and Camas (2005) found that increasing application of humic acid up to1200 (ml/ha) has significantly promoted root and leaf yield of forage turnip (Brassica rape L.). Soil pH increased with rising levels of HA addition and the same trend was also observed for organic C and CEC of the soils by Sharif *et al.*, 2002). Thus, the main objective of this study was to investigate the effects of different amounts of humic acid and nano zn chelated fertilizers on the growth morphological and physiological of Satureja hortensis. The aim of the present study was the effects of foliar spraying of HA and nano zn chelated fertilizers either alone or in combination on the growth, quantitative and qualitative characteristics of savory.

## Materials and methods

*Plant materals and Treatments :(Nano zinc and humic acid and Treatments)*

This experiment was carried out at the research greenhouse of University of Zabol , Iran, in 2013 cropping season. Effects of nano zinc and humic acid on quantitative and qualitative characteristics of savory *(Satureja hortensis L.)*. a factorial experiment was condition in the form of completely randomized design (CRD) on four replications. Plants were treated by different concentrations of Humic acid(0, 0.5, 1, and 1.5cc on each one 1000 m/liters water) and nano ze chelated fertilizer (0, 50, 100, and 200 mg; on each one at 1000 m/liters per water)and control (without using fertilizer).

*Soil analysis*

The seeds of savory were sown in the pots containing 1/5 soil, 3 sand and 1/5 leaf mold (v/v). The pot mixture were tested before applying treatments and the texture was sandy loam with PH=7.20, EC=3.40 dS/m. Plants kept at 22±3/14±3C day/night temperaturesAll of the treatments were sprayed in four stages regularly during growing season with 15 day intervals on the shoot of savory.

*Record data growth condition and measure parameters*

The first spray applied 28 days after sowing at Four-leaf stage and other applied 58 days after sowing and Before flowering.In order to measure parameters, 5 plants were selected randomly from each pot at full flowering stage. Following parameters were recorded for each sample: leaf fresh and dry weight, Phosphorus content, number of leaves per plant and chlorophyll content (SPAD value), essential oil content. (Dark Opal, Genovese, and Sweet Thai) of basil (Nguyen PM, Niemeyer ED, 2008). Nitrogen and phosphorus play important role in essential oil biosynthesis The aerial parts of savory were collected at the flowering stage. Air-drying of plant material was performed in a shady place at room temperature for 10 days. Dried aerial parts (20gr) were subjected to hydro-distillation of dried sample of shoots, using a Clevenger-type apparatus over 3 hours. The oils were dried over sodium sulphate. Qualitative and quantitative analysis of essential oils have been shown in (Table- 2). The essential oil was dried over anhydrous sodium sulfate and then essential oil content (m/lit) and yield for each plot were determined.

*Essential analysis*

The data were subjected to variance analysis using sas (ver.9/1) software. Also, Duncan's multiple range tests was used to compare treatment means at a probability level of 5%.

**Result and discussion**

Results of variance analysis showed that (Table- 1), the effect of humic acid and and nano ze chelated fertilizer management on Plant height, Leaf fresh and dry weight, Phosphorus, Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil content was significant at 1% probability level. But, the interaction effect of humic acid foliar spraying and nano ze chelated fertilizer management on growth). Also, the minimum amount of Plant height fresh and dry weight of leaf and Phosphorus, number of leaves and also chlorophyll content (SPAD value) and essential oil content was obtained by control treatment (without humic acid and nano ze chelated fertilizer application) the highest Plant height of fresh and dry weight of leaf and Phosphorus, number of leaves and also chlorophyll content (SPAD value) essential oil content among interaction effect levels was recorded from $H_4N_4$ treatment (1.5 cc/l foliar spraying of humic acid and 200 on each one at 1000 m/liters per water nano ze chelated fertilizer .resulted has shown that nano ze chelated fertilizer with humic acid and nano ze chelated fertilizer and humic acid have high impact on improvement of grows factor than testator.

**Table-1** Result of analysis variance on studied characteristics in savory Mean square Phosphorous(mg.g-1).

| | | Mean Square | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Treatments | Df | Plant height (cm) | Number of leaves per plan | Leaf dry weight(gr) | Leaf fresh weight(gr) | Chlorophyll content (SPAD value) | Essential oil content (m/lit) | Phosphorous (mg.g-1) |
| humic acid(A) | 3 | 30.26** | 394.06** | 0.002748 ** | 0.011039** | 45.560** | 1.77** | 0.00054** |
| Nano ze chelated fertilizer(B) | 3 | 67.32** | 505.229** | 0.003471* | 0.01503** | 125.91** | 1.94** | 0.000768** |
| A*B | 9 | 3.02** | 15.229** | 0.000031** | 0.000200** | 8.285** | 0.55** | 0.000034** |
| Eror | 48 | 0.3856656 | 2.604 | 0.0000099 | 0.00002604 | 0.0111734 | 0.00727865 | 0.0000166 |
| CV(%) | | 1.690540 | 4.894766 | 7.792778 | 5.535570 | 1.391335 | 6.283990 | 2.883873 |
| R-Square | | 0.945320 | 0.957769 | 0.975399 | 0.984624 | 0.999090 | 0.970881 | 0.841388 |

ns= Non significant, ** = $p < 0.01$, and * = $p < 0.05$.

*Plant height*

Results from variance analysis indicated that humic acid treatments and nano ze chelated fertilizer and interaction effect of these two treatments have significant in 1 % probability level effect on the height of Savory plant (Table-1). However, the highest (39.9200 cm) and lowest (30.7500 cm) plant height was related to control treatment, respectively (Table-2). maximum plant height was gained from N4 fertilizer treatment and minimum plant height was related to the treatment without fertilizer (Table-4). minimum plant height (34.81cm) of the treatment without fertilizer or control and maximum plant height of treatment were gained in H4 with (37.96cm) (Table-3). Also by examining the yield, yield elements and morphological traits wheat in different treatments of micro-nutrient fertilizers (Mostafavirad *et al.*, 2008), also reported that simultaneous consumption of Zn and Mn led to the 6.8% increase of wheat plant height compared to control treatment. Other results in examination of humic Acid effect on growth of roof show that most growth beginning is in 54 mg/l viscosity of humic Acid, which increasing root's absorption capacity in the presence of humic Acid, which be the factor of increasing growth increasing(Vaughan.and.Linehan, 1976).

**Table 2.** Means comparison of the main effects humic acid of and nano ze chelated fertilizer treatments on morphophysiological and agronomical traits of savory (*Satureja hortensis* L.).

| Treatments | | Traits | | | | | | |
|---|---|---|---|---|---|---|---|---|
| humic acid | nano ze chelated fertilizer | Plant height (cm) | Number of leaves per plant | Leaf dry weight (gr) | Leaf fresh weight (gr) | Chlorophyll content (SPAD value | Content Essential oil m/lit | phosphorous (mg.g-1 ) |
| 0 (without using humic acid) | 0 (without using nano ze chelated fertilize ) | 30.7500 g | 19.00 h | 0.004000 h | 0.020000 i | 1.40750 l | 0.62500 h | 0.117500 d |
| | 50mg on each one at 1000 m/liters water | 34.39 hi | 24.00 g | 0.022250 fg | 0.055000 g | 4.3600 j | 0.85000 g | 0.135000 c |
| | 100mg on each one at 1000 m/liters water | 36.8950 fg | 30.00 e | 0.029250 e | 0.072500 f. | 8.45500 e | 1.12500 f | 0.140000 bc |
| | 200mg on each one at 1000 m/liters water | 37.2250 efg. | 33.00 d | 0.029250 e | 0.070000 f | 8.75250 d | .1.34000 e | 0.140000 bc |
| ./5cc on each one 1000 m/liters water) | 0 (without using nano ze chelated fertilize ). | 33.8500 i | 23.00g | 0.021500 g | 0.047500 i | 3.95000 j | 0.75000g | 0.135000 c |
| | 50mg on each one at 1000m/liters water | 36.45g | 35.00cd | 0.043750 d | 0.085000 e | 6.31750 h | 1.29000 e | 0.140000 bc |
| | 100mg on each one at 1000 m/liters water | 38.000 cde | 35.50cd | 0.052750 c | 0.1225000 cd | 8.83750d | 1.39000 de | 0.147500 a |
| | 200 on each one at 1000 m/liters water | 38.6250 bc | 26.50f | 0.056750 bc | 0.1225000 cd | 7.33750 f | 1.52500 c | 0.147500 a |
| 1cc on each one 1000 m/liters water | 0 (without using nano ze chelated fertilize ) | 36.75 fg. | 33.50d | 0.026250 ef | 0.060000 g. | 5.65750 i | .1.02500 f | 0.135000 c |
| | .50 on each one at 1000 m/liters per water | .37.45 efd | 39.00b | 0.044500 d | 0.115000 d | 6.72000 g | 1.35000 e | 0.145000 ab |
| | 100 on each one at 1000 m/liters per water | 38.500 bc. | 40.50b | 0.058500 b | 0.130000 abc | 8.73750 d | 1.55000 c | 0.150000 a |
| | 200 on each one at 1000 m/liters per water | .39.1500 bc | 33.00b | 0.059750 b | 0.132500ab.. | 14.06250 a | 1.80000 b | 0.147000 a |
| 1/5 cc on each one 1000 m/liters water) | . 0 (without using nano ze chelated fertilize ) | .35.000 h | 33.00d | 0.029500e | 0.067500 f | 5.73250 i | 1.3000 e | 0.140000 bc |
| | 50 on each one at 1000 m/liters per water | .36.5750 fg | 36.50c | 0.045000 d | 0.115000 d | 8.86750 d | 1.47500 cd | 0.145000 ab |
| | 100 on each one at 1000 m/liters per water | .38.225 bcd | 40.00b | 0.059250 b | 0.125000 bc | 10.30000 c | 2.15000 a | 0.150000 a |
| | .200 on each one at 1000 m/liters per water | .39.9200 a | 43.50 a | 0.065500 a | 0. 135000 a | 12.05250 b | 2.17750 a | 0.150000 a |

Mean with the same letters in each column does have significant difference at the 1% level of probability.

*Leaf fresh and dry weight*

Results of variance analysis table (table-1) indicate that effect of humic acid and nano ze chelated fertilizer and the interaction effect of nano ze chelated fertilizer and on Leaf fresh and dry weight was significant in 1 % probability level. and the highest (0. 135000 gr) leaf fresh weight was obtained by utilization the interaction of humic acid and nano ze chelated fertilizer and lowest (0.020000 gr) leaf fresh weight content was gained by control (without using of humic acid and nano ze chelated fertilizer), respectively (Table-2). The maximum (0.065500 gr) and minimum (0.004000 gr) of leaf dry weight was observed by application 200 on each one at 1000 m/liters per water and 1/5 cc on each one 1000 m/liters water) of conmethanol with nano ze chelated fertilizer and humic acid to control treatment, respectively (Table-2). The results indicated that the lowest leaf fresh weight was achieved in N1 fertilizer treatment with 0.0487gr and the greatest leaf fresh weight was related to N4, N3 fertilizer treatment, respectively with 0.115gr and 0.112gr. (Table-4) The maximum leaf dry weight was in N4 with0.052813 and there was significant difference between the two treatments. Also N1 fertilizer treatments with 0.020313 mean the lowest leaf dry weight and there was significant difference between two treatments (table4). Minimum leaf fresh weight (0.0543 gr) was resulted from control treatment and Maximum leaf fresh weight was in N4 with (0.110 gr) gained (Table-3). greatest leaf dry weight was achieved in H4 fertilizer treatment with (0.049813gr)and the lowest leaf dry weight was achieved in H1 fertilizer treatment with (0.021188 gr) (Table-3). Bahmanyare *et al.*, (2005) showed that Foliar application of Zn and B had a positive effecte on Khazar variety of rice and the yield was increased rapidly and nutrient deficiency was compensated. On the other hand, micro-nutrient elements like Zn take part in the construction of some proteins and also in azoth metabolism and thereby lead to the yield increase (Parhamfar, 2006). Malikowjona *et al* (1987) showed that 30kg humic Acid in one hectare significantly increased the function of dry material of stem and root. Also, show that the root ratio to stem is more am aunt Drnbus *et al* (1989) indicated budding and plant dry weight as normal soybean decreased when placed on drought shock during seed filling.

**Table 3.** Means comparison of the main effects humic acid of treatments on.

| Treatment | Plant height(cm) | Number of leaves per plant | Leaf dry weight (gr) | Leaf fresh weight(gr) | Chlorophyll content (SPAD value) | Essential oil content (m/lit) | phosphorous (mg.g-1 ) |
|---|---|---|---|---|---|---|---|
| H1 | 34.815d | 26.5000d | 0.021188 d | 0.05437c | 5.74375d | 0.98500d | 0.133125c |
| H2 | 36.733c | 32.2500c | 0.043688c | 0.09437b | 6.61063c | 1.23875c | 0.142500b |
| H3 | a37.962 | 34.8750b | 0.047250b | 0.10937a | 8.79438b | 1.43125b | 0.14437 ab |
| H4 | 37.429b | 38.250a | a0.049813 | 0.11062a | 9.24063a | 1.77563a | 0.146250 a |

Morphophysiological and agronomical traits of savory (*Satureja hortensis* L.).

$H_1$:Contro(0 without using nano ze chelated fertilize ) humic acid

$H_2$: treatment(humic acid (./5cc on each one 1000 m/liters water) humic acid

$H_3$: treatment (humic acid(1cc on each one 1000 m/liters water) humic acid

$H_4$: treatment(humic acid(1.5cc on each one 1000 m/liters water) humic acid

* was not significant.

*Number of leaves per plant*

Results of variance analysis table (table-1) indicate that effect of humic acid and nano ze chelated fertilizer and the interaction effect of nano ze chelated fertilizer and on number of leaves per plant was significant in 1 % probability level (Table-1). the highest (43 leaves plant-1) and lowest (19 leaves plant-1) of number of leaves per plant was gained by control and and humic acid sole, respectively (Table-2). In addition, the greatest Number of leaves per plant was achieved in H4 fertilizer treatment with 38 The lowest Number of leaves per plant in $H_1$ treatment was 26 (Table-3). the greatest Number of leaves per plant was related to $N_4$ fertilizer treatment with 38 and the lowest Number of leaves per plant was related to $N_1$ fertilizer treatment with 25(Table-4). Abdossalam *et al.*, (1994) showed that foliar application of Zn had the most effective influence as compare with soil application of Zn on increased of yield. Humates are natural organic substances, high in humic acid and containing most of known trace minerals essential to the growth of plant life. studies of the positive effects of humic substances on plant growth have demonstrated the importance of optimum mineral supply,independent of nutrition (Yildirim, 2007).

**Table 4.** Means comparison of effects nano ze chelated fertilizer treatments on morphophysiological and agronomical traits of savory (*Satureja hortensis* L.).

| Trematment | Plant height(cm) | Number of leaves per plan | Leaf dry weight(gr) | Leaf fresh weight (gr) | Chlorophyll content (SPAD value) | Essential oil content m/lit | phosphorous (mg.g-1 ) |
|---|---|---|---|---|---|---|---|
| N1 | 34.0875 d | 25.375 d | 0.020313 d | 0.04875 c | 4.18938 d | 0.92500 d | 0.131875 c |
| N2 | 36.2181 c | 32.250 c | 0.038875 c | 0.09250 b | 6.56625 c | 1.24125 c | 0.141250 b |
| N3 | 37.9044 b | 36.125 b | 0.049938b | 0.11250 a | 9.08250 b | 1.55375 b | 0.146875 a |
| N4 | 38.7300 a | 38.125 a | 0.052813 a | 0.11500 a | 10.55125 a | 1.71063 a | 0.14625 a |

$N_1$ :control (0 without using nano ze chelated fertilize)

$N_2$ :treatment 50mg on each one at 1000 m/liters water nano ze chelated fertilizer ،

$N_3$ :treatment 100mg on each one at 1000 m/liters water .nano ze chelated fertilizer

$N_4$ :treatment 200mg on each one at 1000 m/liters water nano ze chelated fertilizer.

* was not significant.

*Chlorophyll content (SPAD value)*

The interaction effect of humic acid × nano ze chelated fertilizer and effect of humic acid and nano ze chelated fertilizer on chlorophyll content was significant in 1 % probability level (Table-1). The results indicated that the highest (12.05 SPAD value) chlorophyll content was obtained by utilization the interaction of humic acid and nano ze chelated fertilizer and the lowest (1.4 SPAD value) chlorophyll content was gained by no application of humic acid and nano ze chelated fertilizer (Table-2). Maximum Chlorophyll content was related to the H4 treatment minimum was also related to not-using-fertilizer treatments and reproductive stages (Table-3). The greatest Chlorophyll content was related to N4 fertilizer treatment with 9.24 and lowest Chlorophyll content was related to N1 fertilizer treatment with 5.74 (Table-4). Humic acid improves the physical, chemical and biological properties of the soil and influences plant growth (Chen *et al.*, 2001). nitrogen and phosphorus are the most limiting nutrients to vegetative production but their sufficient use by majority of the smallholder farmers become limiting due to their high costs. there are several problems which are impeding the balance and efficient use of fertilizers. They may be well addressed by the application of humic acid. It seems that humic substances may influence both respiration and photosynthesis (Nardi *et al.*, 2002)..Humic substances are an important soil component because they constitute a stable fraction of carbon and improve water holding capacity, pH buffering and thermal insulation (McDonnell *et al.*, 2001).

*Phosphorus content*

Results of variance analysis table (table-1) the interaction effect of humic acid× nano ze chelated fertilizer had significant ($P<0.01$) effect Phosphorus and indicate that effect of humic acid and nano ze chelated fertilizer on Phosphorus content was significant in 1 % probability level. Also, the maximum Phosphorus(0.1500 mg.g-1) was observed at treatment the interaction of humic acid and nano ze chelated fertilizer, and the minimum Phosphorus (0.1175 mg.g-1) and dry weight (0.16 mg.g-1) was related to treatment of no humic acid and nano ze chelated fertilizer, and no nano ze chelated fertilizer and humic acid, respectively (Table-2). that the greatest Phosphorus content was achieved in H4 fertilizer treatment with 0.146 mg.g-1 and the lowest Phosphorus content was related to N4 fertilizer treatment, with 0.133 mg.g-1 (Table-3). Additionally the greatest Phosphorus content was related to N3, N4 fertilizer treatment, respectively with (0.1468 mg.g-1) (0.1462 mg.g-1) and the lowest Phosphorus content was related to $N_1$ fertilizer treatment with 0.131 mg.g-1 (Table-4). HA is a suspension, based on potassium-humates, which can be applied successfully in many areas of plant production as a plant growth stimulant or soil conditioner for enhancing natural resistance against plant diseases and pests (Scheuerell and Mahaffee, 2004 ; Scheuerell an Mahaffee, 2006), stimulation plant growth through increased cell division, as well as optimized uptake of nutrients and water, moreover, HA stimulated the soil microorganisms (Atiyeh and Edwards *et al.*, 2002 ; Chen *et al.*, 2004). When adequate humic substances are present within the soil, the requirement for nitrogen,phosphorus and potassium fertilizer applications may be reduced (Pettit, 2004). Humic acid (HA) and phosphorus applications increased the growth and growth parameter of pepper seedling. the combined effects of HA and P application was more effective on growth and growth parameter than each separate effect. Humic acid application significantly increased N, P, K, Ca, Mg, S, Mn and Cu contents of shoot of pepper seedling (K. Mesut, 2010). Some enzymes contain zinc such as carbonic Anhydrase, Carboxypeptidase, alcohol dehydrogenase, alkaline phosphatase, phospholipase and RNA dymerase which reduced protein synthesis through zinc deficiency (WWW.en.makepolo.com).

The stimulatory effects of humic substances have been directly correlated with enhanced uptake of macronutrients, such as nitrogen, phosphorus; sulfur, and micronutrients, that is, Fe, Zn, Cu and Mn (Chen *et al.*, 1999). several factors effect on the absorbable amount of zinc in the peanut cultivation soils. These factors are including paucity of zinc containing minerals in the soils, presence of alkaline pH, and high amount of calcium carbonate and light weight of the soil texture in the peanut fields (Pilevary *et al.*, 2008).

*Essential oil content*

Although the interaction of humic acid× nano ze chelated fertilizer had significant in 1 % probability level on the content of essential oil, and effect of humic acid and nano ze chelated fertilizer on the content of essential oil was significant in 1 % probability level too (Table-1). The highest content of essential oil was observed in the interaction of humic acid and nano ze chelated fertilizer. The lowest content of essential oil was observed in control treatment (Table-2). results of means comparison from Duncan interaction of humic acid and nano ze chelated fertilizer l showed that led to the increase of essence content and the treatment had the maximum essence oil content (1.775m/lit) and had also the least essence oil content (0.985m/lit) (Table-3).Thought the effect of micro-nutrient fertilizers on essence yield was statistically significant, results of means comparison showed increase of essence content in Zn+ humic acid consumption conditions compared to control treatment. The consumption of Zn and humic acid separately had significant differences with using them together (Table-1). The maximum Essential oil content was in N4 and N3 with 1.710 m/lit and 1.553 m/lit, respectively and there was significant between the two treatments. Also N1 fertilizer treatments with 0.925 mean the lowest Essential oil content (table-4). Bagheri an Mazaherilaghab, (2004) reported that the application of low consumption elements Mn and Zn can have positive significant effect on the growth and chemical compositions of Cuminum cyminum essence and the use of their mixture showed further effect. Metal ions such Fe, Zn, Cu, Mn and Mg are essential mineral micronutrients and cofactors of most antioxidant enzymes (Marschener and Cakmak, 1986).

plant height, Leaf fresh and dry weight, Phosphorus,Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil of savory were obtained by addition of $n_4h_4$ in base medium, Results showed that the interaction humic acid and nano ze chelated fertilizer significantly increased and plant height, Leaf fresh and dry weight, Phosphorus,Number of leaves per plant, Chlorophyll content (SPAD value) and Essential oil, respectively.

*Recommendations*

1. It is recommended that other humic acid and nano ze chelated fertilizer are examined and tests are reported in the places and years.

2. According to the trace elements shortage rate in the cultivating soils and humans need to these elements it is suggested that necessary micronutrients be provide for the plant in adequate amounts.

3. Since zinc nano ze chelated fertilizer will increase

the humic acid adoption and thus increases the yield elements, it is recommended that two fertilizer treatment to humic acid and nano ze chelated fertilizer being utilized with suitable rates alongside each other due to their positive effects.

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