Effect of Drought Stress Levels and Organic Manures on Yield, Essential Oil Content and Some Morphological Characteristics of Sweet Basil (Ocimum basilicum)

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**A B S T R A C T**

In order to study the effects of drought stress and biofertilizers (Humic acid, compost and manure) on quantity and quality characteristics of basil (Ocimum basilicum) a field experimental was conducted in split plot design with three replications in 2012 at University of Zabol research farm. Drought stress treatments included: S1: control (100% FC), S2: moderate stress (80% FC) and S3: severe stress (60% FC) as the main plot and application of biofertilizer: N1: 40 ton compost ha⁻¹, N2: 40 ton manure ha⁻¹, N3: 6 liter of humic acid per hectare as sub plot. Results indicated that the drought stress had significant impact on dry weight of basil and decreased it compared with the control. The greatest yield (886.5 kg ha⁻¹) and other morphologic characteristics (leaf number, plant height, stem diameter, number of lateral branch) were obtained in no stress along with application of 4 0 ton compost ha⁻¹. Essential oil content increased with increasing drought stress severity. This study suggests due to increasing essential oil content at the 80% FC, the cultivation of basil at the 80% FC together with application of compost at Zabol condition is suitable.

**INTRODUCTION**

Basil (Ocimum basilicum) from Lamiaceae has important medicinal properties include hypoglycemic, antispasmodic, sedative, lowering blood pressure, lowering fever, body compatibilizer stressors and strengthening the body’s natural activity and anti-inflammation [6].

Water scarcity occurs when the plant is water loss due to transpiration is greater than the absorption rate., This may be due to excessive water loss or reduction of the absorption of water and is both 14. Lack of water, cell volume, cell division, cell elongation, the overall size of the plant and plant dry weight as the main criteria for growth often fall. One of the first signs of water shortage, reducing turgor pressure and consequently reduced cell growth and development, particularly in stems and leaves. The process is sensitive to cell growth is affected by water deficit. Organ size is limited by a decrease in cell growth and therefore the first tangible effects of dehydration on plants can be smaller than the size of leaves or height of plants can be detected [13,21,26].

Increase soil organic matter and nutrient supplies in sufficient quantities and quality play an important role in the production of agricultural products and the sustainable management of soil nutrients and maintain balance due to its fertile important. Nutrients by the plant should be removed from the land, the natural organic fertilizer and chemical injection should be returned to the ground [27].

The use of compost in the soil generally in order to maintain and increase aggregate stability, fecundity and fertility of soils for farming and gardening in the past decade has been of particular importance. In addition to the loss of the extra costs and waste disposal, which will lead to more efficiency and usefulness [23]. Compost as an organic fertilizer can be affordable with good value and can be used as alternative in sustainable agriculture and organic farming, is of a special place [37]. We use various organic acids to improve and increase the quality and quantity of crops and garden is being developed [9].

The purpose of this experiment was to examine the effects of drought and some organic fertilizers such as compost and manure on a number of characteristics of Humic acids and essential herbs basil and relationships between these factors is the best ratio.
MATERIALS AND METHODS

The experiment was conducted in 2012 at the Agricultural Research Station in Zabol University. Climate is hot and dry region classification component parts. Analysis of soil physical and chemical properties before running the tests presented in Table 1:

Table 1: Physical and chemical testing of soil at a depth of 30-0 cm.

<table>
<thead>
<tr>
<th>Electrical conductivity dS m</th>
<th>pH</th>
<th>Nitrogen</th>
<th>Phosphorus</th>
<th>Potassium</th>
<th>Organic carbon</th>
<th>Organic</th>
<th>Silt</th>
<th>Clay</th>
<th>Sand</th>
<th>Soil texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.1</td>
<td>4.8</td>
<td>3.6</td>
<td>2.9</td>
<td>115</td>
<td>47.0</td>
<td>81.0</td>
<td>20.4</td>
<td>31.6</td>
<td>48</td>
<td>Sandy clay loam</td>
</tr>
</tbody>
</table>

A split plot experiment in randomized complete block design with three replications was conducted. After tillage, the plots with dimensions of 1.5 x 1 mm were prepared in accordance with the planting plan. Distance between the plots between half a meter and a meter blocks were considered. Stress as a major factor in three levels, including irrigation at 60, 80 and 100% of field capacity and fertilizers as sub-plots consisted of four control or lack of fertilizer, compost (40 tons per acre), cow manure (40 t ha) and humic acid (6 liters per hectare). After planting includes weeding, watering and regular crust was broken. Until the germination of seeds, watering the surface and took each day. Drought treatment was imposed after the thinning. Soil moisture measuring device TDR. Soil moisture was used when any of the specified values are reached, basin irrigation method was performed. Before the end of the vegetative period number 8 plants per plot were randomly selected and cut from the crown area and height, number of lateral shoots, number of leaves per plant and stem diameter were measured. Vegetative organs harvested for measuring the dry weight of In-room flat in the shade on the paper at 25 ° C were dry naturally. Well as dry yield per hectare, essential oils, essential oil content of nitrogen, phosphorus and potassium were measured. Extracting essential oils from the leaves and stems of dried basil and by consuming oil and water distillation was conducted in a university research lab. After calculating the total weight of the oil, yield per unit area (g ha) was determined.

Software MSTATC was used for statistical analysis. Mean comparisons using least significant difference (LSD) carried out with the help of diagrams Excel.

RESULTS AND DISCUSSION

Number of leaves per plant:

According to Table 2, compared to the average effect of drought stress (Table 3) showed that the highest number of leaves (25.66) at 100% of field capacity (without stress) were obtained from the least (08.44) of the Acts high water stress (60% field capacity), respectively. Dehydration stress, the number of leaves per plant was reduced. Reduce the number of leaves during drought stress due to aging plant and a high concentration of ethylene, a way to reduce transpiration and plant faster to escape the stress is dealt. [13] The research work Hassani et al [8] and Ardekani et al [5] also increased with dehydration conditions on basil and lemon balm (Melissa officinalis). The leaf area per plant was reduced. Experiment on sunflower plants in Turkey weather treatments (60 and 40% of field capacity) Reported height and leaf area reduction [20]. With increased levels of stress, and weakens the cell wall and decreased cell volume, low pressure potential and pressure potential is dependent on the conditions of cell development, reduced, leading to reduced growth. These factors reduce the number of leaves per plant and leaf size is [28]. The effect of fertilizers on leaf number (Table 4) it was found that the greatest number of leaf compost application number 56.66, respectively, and the lowest non-application of fertilizer (control), respectively. Manure and humic acid production 22.55 Leaves in a single statistical group.

In general, the use of any kind of manure can lead to an increase in the number of leaves per plant basil. Use of compost in the soil will increase the absorption of macronutrients, such as increased nutrient P, N and K. Due to high levels of these nutrients in the soil is often associated with increased nitrogen, phosphorus, potassium and organic carbon in the rhizosphere. Compost with plenty of organic matter in soil that is fertile ground for the growth of microorganisms in the soil has a major role in improving the structure and adjustment. Compost mixed with soil bulk density increases with decreasing water availability is reduced and may increase the water is evaporated [32].

The number of lateral branches:

For this trait, the effects of water stress and fertilizer was significant (Table 2). Survey work on dry surfaces, it was found that the average number of side branches without tension control, the greatest number of side branches (92.10) and 80% of production FC With (75.8) was not significantly different from control levels. The least number of side branches, 60% of field capacity (Table 3). The results obtained in this test case number and function of stem those by Asgharipour and Rafiei [3,4,5,6], Rafat and Saleh [33] and Hosni and Asgharipour and Rafiei [3] the study of basil, which was intensified drought reduced the number of stems...
correspond. Branch high under drought conditions is considered an undesirable trait because it makes it unnecessary consumption and waste of soil moisture. Asgharipour and Rafiei [12] limited branch under drought conditions in the hemp plant as a coping mechanism by which the plant tries to blame the water for more critical stages of development, such as flowering, to maintain. Drought stress conditions reduce the number of stems. Perhaps Basil considered an adaptation mechanism. The effect of fertilizer type (Table 4). The experiment turned out 4 consumption greatest effect on the production of one ton of side branches (67.10) and the lowest non-application of fertilizer (control), respectively. Manure production (44.9) and humic acid production (78.8) compared to the control sample showed its effects.

Table 2: Analysis of variance of traits basil.

<table>
<thead>
<tr>
<th>Sources of change</th>
<th>Degrees of freedom</th>
<th>Mean-square Drying Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat</td>
<td>2</td>
<td>25.3360 *0.0323 90.68 47.309 33.170821</td>
</tr>
<tr>
<td>Drought</td>
<td>2</td>
<td>08.1475 *53.42 52.17 25.246 88.133866</td>
</tr>
<tr>
<td>Error 1</td>
<td>4</td>
<td>21.163 94.4 72.0 85.10 65.6180</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>3</td>
<td>56.303 *41.22 63.9 90.128 81.146031</td>
</tr>
<tr>
<td>Tension * Fertilizer</td>
<td>6</td>
<td>19.16 *05.1 07.0 02.4 10.4098</td>
</tr>
<tr>
<td>Error 2</td>
<td>18</td>
<td>04.13 86.0 37.0 72.5 03.797</td>
</tr>
<tr>
<td>Coefficient of Variation (%)</td>
<td></td>
<td>53.6 37.10 58.8 78.8 67.4</td>
</tr>
</tbody>
</table>

Table 3: Comparison of mean stress effects on morphological traits measured basil.

<table>
<thead>
<tr>
<th>Stress levels</th>
<th>100% of field capacity</th>
<th>80% of field capacity</th>
<th>60% of field capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tdadbrg plant</td>
<td>a 25.66</td>
<td>ab 67.55</td>
<td>b 08.44</td>
</tr>
<tr>
<td>Tdadshakhlk</td>
<td>a 92.10</td>
<td>a b 75.8</td>
<td>b 17.7</td>
</tr>
<tr>
<td>Stem diameter (mm)</td>
<td>a 31.8</td>
<td>ab 13.7</td>
<td>b 89.5</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>a 88.31</td>
<td>a b 99.26</td>
<td>b 83.22</td>
</tr>
</tbody>
</table>

Common letters indicate no significant difference in the level Hrstr variance analysis table is concerned.

Stem diameter:

For this trait (Table 2) Effects of water stress and fertilizer was significant at 1% level, respectively. Comparison of the mean effective stress (Table 3) was observed that the highest stem diameter (31.8 mm) at 100% of field capacity (without stress) were obtained from the least (89.5 mm) to 60% capacity were conducted. Dehydration stress, the diameter of stems per plant was reduced. The research work Krnak and colleagues [22] Stress and reduce water use in corn significantly reduced plant height, stem diameter, leaf area index and dry matter was. The effect of fertilization on stem diameter (Table 4) was observed at the highest dose of compost application rate of stem diameter of 33.8 mm, respectively, and the lowest non-application of fertilizer (control), respectively. Effect of farmyard manure (30.7 mm) and humic acid (98.6 mm) on stem diameter were not significantly different from each other.

Table 4: Comparison of the average effect of organic fertilizer on quantitative and morphological traits measured in the basil.

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Control without fertilizer</th>
<th>Manure</th>
<th>Compost</th>
<th>Hyvmik acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tdadbrg plant</td>
<td>c 33.48</td>
<td>b 22.55</td>
<td>a 56.62</td>
<td>b 22.55</td>
</tr>
<tr>
<td>Tdadshakhlk</td>
<td>c 89.6</td>
<td>a 67.10</td>
<td>a 56.62</td>
<td>b 89.6</td>
</tr>
<tr>
<td>Stem diameter (mm)</td>
<td>c 52.5</td>
<td>b 30.7</td>
<td>a 33.8</td>
<td>b 98.6</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>c 20.22</td>
<td>b 52.27</td>
<td>a 58.31</td>
<td>b 84.27</td>
</tr>
</tbody>
</table>

Common letters in each row indicate no significant difference in the level of analysis of variance table.

Plant height:

According to Table 2, compared to the average effect of drought stress (Table 3) showed that the highest plant height (88.31 cm) at 100% of field capacity (without stress) were obtained from the least (83.22 cm) related to increased water stress (60% field capacity), respectively. 80% of water stress with a 99.26 cm height was a significant difference with the control. Lbaschy & Noble Ashvрабади [15] irrigation treatments 25, 50, 75 and 100% of field capacity on plants, PP, yarrow, sage, always Spring and daisies review and concluded intensifying drought, shoot weight and plant height was reduced in all plants studied. Because of the growing phenomenon of critical activities in the absence of the plant, water should be sufficient, in the absence of water required to reduce the pressure on the effect of growing cell Tvrzhsans of cells, to low altitude [3]. Effect of fertilizer type (Table 4) This study showed that consumption of 4 0 K M Pvst greatest effect on plant height (38.31 cm) and the lowest non-application of fertilizer (control), respectively. Manure and humic acid effect on height (52.27 and 84.27 cm) were used in a group. ’s Research on PP plant ovate ( Plantago Mixed municipal solid waste compost and soil in greenhouse conditions with a ratio 80.20 municipal solid waste compost
increased compared to control 5.23 percent psyllium plant height in the pot [2]. Then applying organic fertilizers (especially salinity) can be The effective stress is partially reducing the incidence of adverse effects.

Drying Performance:
Effects of drought stress on the 5% level for the type of fertilizer and the interaction of both factors was significant at the one percent level, respectively (Table 2). The effect of stress levels on average dry yield was found that the level of stress (control), dry yield (5.721 kg per ha) was produced. Level of 80% (4.575 kg per ha) was significantly different from the control level and the lowest dry yield (3.516 kg per hectare), the level was 60% of field capacity (Table 5). The research work of Carter and colleagues [16] concluded that water deficit reduced yield and reduce the number of stem diameter, internode length and leaf size is in alfalfa. Safi Khani [10] in their research on medicinal plants Deracophalum moldavica L. drought reported in 40% of field capacity field reduces the height, length and width of the leaves and the shoots. Levels of plant resistance against drought stress on the sensitivity of each component yield in drought stress and stress intensity are faced with’s total dry matter yield stress is reduced due to the closure of the openings in the stress condition availability CO makes it difficult for the system and to reduce leaf photosynthetic plant. Despite high leaf area index and its preservation during stress and decrease in plant transpiration by closing stomata is very effective in maintaining the stability and performance [13]. The effect of fertilizers on dry yield (Table 6) it was found that the highest yield of dry compost application rate of 768 kg per hectare, respectively, and the lowest non-application of fertilizer (control), respectively. Using manure dry matter (7.617 kg per hectare) and the application of humic acid to the amount of dry matter (0.571 kg per ha) was produced, which was not significantly different from each other. He can use any kind of manure can lead to increased performance in the basil is dry. Organic fertilizer with chelated macro fertilizers in alkaline soil to the area and create an acidic condition giving attracting and micro nutrients for plants are.’s In a greenhouse experiment, the effect of different levels of organic matter in the dry matter and chemical composition of maize were studied Increase soil organic matter and dry matter yield of maize significantly increased [19]. Compost used in other experiments in the field of spring barley increased by 25 percent dry matter and seed number per plant increased [18]. The effect of interaction On average, dried basil performance at low stress level and H Water, dry yield (5.886 kg ha) The application of compost, while the increased stress levels down and the lowest dry matter yield (1.398 kg per hectare) to the non-application of fertilizer (control), respectively (Figure 1). The lack of application, increasing drought, yield decreased. In this review, the compost, manure application increased the salinity of the application of humic acid was not significantly different. General stress exert their effects by reducing the number of leaves, plant height, number of lateral branches has led to a decline in stem diameter and dried basil. But with the use of organic fertilizers and their effects on the growth of basil, drought stress reduced and performance is more than the absence of organic fertilizer received. Therefore suitable for in vitro use of compost in agriculture Basil looks. Ahmadian et al [4] investigated Interaction Tension Drought And Consumption Fertilizer Animal On Characteristics Quantitative And Qualitative Cumin Green Declaration Were The Consumption 20 Ton At Ha Fertilizer Animal To reduce Effects Negative Tension Drought Cause Increase Of Material Dry And Alternative Irrigation was also reported They The Deficiency Water Reduced Performance Biological And The Reduction Growth Plant Cumin and improve Characteristics Quality Oil Will. Despite this Interaction effects of drought on levels 50, 70 and 90% of field capacity and four fertilizer contains no fertilizer, fertilizer, animal manure (25 t ha) and municipal solid waste compost (25 tons per acre) on the plant Chamomile by Elements [1] determined that the land was not (control), dried manure has the greatest impact on performance but during drought stress and reduce it to 50% of field capacity, the most effective use of organic fertilizers The dry performance.

Percent oil:
Drought and Fertilizer and interactions of essential oils of basil significant effect on the stands (Table 7). Comparison Average Data At Level Show the 5% The With Increase Level Tension Drought Of Witness 80% Capacity Crop On Percent Essence Basil Additional Will. Every Several At During Update Drought Until 60 percent Capacity Crop Percent Essence Change Not Not But Maximum Percent Essence Production At This Experiment At 80 percent Capacity Crop To Amount of 4953.0 mm Hot On Liter Observation Were (Table 5). Results A similar increase in the percentage of oil in drought stress By Letchamv and colleagues [25] Hosni and Amydbygy [7] on Plant Basil And Rpak and colleagues (34) On Chamomile and lustrous and colleagues [12] on Peppermint To Hand The ‘s. Charles et al. Mint [17] And elation and Saleh [33] At Basil Also Report They That With Reduction Moisture Soil Percent Essence Increase The Finds.’s Experiment The Hosni And Amydbygy [7] on Plant Basil, Most Percent Essence At Regime Blue 70% Capacity Farm To Hand Come. In this experiment, no significant differences in the types of fertilizers on oil production were observed (Table 7). Each type of fertilizer to increase the percentage of essential oils, but most of the average 5018.0 milligrams per liter of manure (Table 8).
related to stress levels, according to the above table we can say.

The application of humic acid can also be used.

Table 5: Comparison of the yield stress measured basil.

<table>
<thead>
<tr>
<th>Levels Tension Traits</th>
<th>(Control), 100% of field capacity</th>
<th>80% of field capacity</th>
<th>60% of field capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry function (kg ha)</td>
<td>a 50.721</td>
<td>ab 40.575</td>
<td>b 30.516</td>
</tr>
<tr>
<td>Percent oil</td>
<td>ab 4372.0</td>
<td>a 4933.0</td>
<td>b 4253.0</td>
</tr>
</tbody>
</table>

Common letters indicate no significant difference in the level. Hsr corresponding analysis of variance table is

Table 6: Comparison of the average effect of organic fertilizers on the yield measured in the basil.

<table>
<thead>
<tr>
<th>Fertilizer Traits</th>
<th>Control without fertilizer</th>
<th>Manure</th>
<th>Compost</th>
<th>Hyvmyk acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry function (kg ha)</td>
<td>d 80.460</td>
<td>b 70.617</td>
<td>a 0.768</td>
<td>c 0.571</td>
</tr>
</tbody>
</table>

Common letters indicate no significant difference in the level of analysis of variance table is

From Figure 2 it is clear that most of the oil and application of humic acid was obtained in 80% of field capacity and high stress levels, the lowest percentage of oil (Fc 60%) in the general application of humic acid in water levels, essential oil percentage was more related to stress levels, according to the above table we can say that the stress levels (60 and 80 percent Fc) And in compliance with applicable water saving compost and manure can be a reasonable percentage of the oil produced while the level of 80% humic acid can also be used to produce a good performance.

REFERENCES