Effect of Irrigation Regime and Different Superabsorbent Levels on Water Productivity, Growth Characters and Yield of Tomato (*Lycopersicon esculentum* L.)

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**ABSTRACT**

*Background:* This experiment was carried out split plot in randomized complete blocks design with three replications at north of Iran, Boushehr province in Ahram region in 2013. Irrigation region in three levels including (30, 50 and 70% discharge of available moisture content) as main plots and five humidity superabsorbent including (0, 0.25, 0.5, 0.75 and 1% by weight) as sub plots. Results showed that the most final yield was obtained in 30% discharge of available moisture content. Water productivity in 70% discharge of available moisture content because of decrease water use and water requirement had observed with 1% superabsorbent application. The most fruit number per plant was obtained at interaction of 30% discharge of available moisture content and 0.75% superabsorbent application and interaction of 50% discharge of available moisture content and 0.25% superabsorbent application. The highest water productivity was observed at interaction of 70% discharge of available moisture content and 1% superabsorbent application. Therefore, superabsorbent application because of decrease water use in plant causes to increase yield and water productivity.

**INTRODUCTION**

The tomato family is Solanaceae that scientific name is *Lycopersicon esculentum* that one of the most crop for semi-dry and Mediterranean region. Tomato is one of horticulture crop in Iran and other country. Iran frequently affected areas are arid and semi arid climates. Recent droughts have increased, especially on the problem of water scarcity. Agriculture section is major consumers of water resources. One of water saving methods is the use of additives to the soil that super absorbent polymer is the most noted [2]. Water stored in case of dehydration in the material released in the soil and are used from plant roots [5]. In the process of transferring seedlings from the nursery to the field, in general some of them are not able to handle the transition affect the transition shocks die. Super absorbent core transferring seedlings to the cause of shock resulting from the transfer of the seedlings to endure and find of faster and better [6]. With application of superabsorbent grain yield, 100 seed weight, harvest index, number of grain per pods and number of pods per plant had been significantly increased [7]. Baghaei [1] reported that water stress in pollination stage and fertilization stage in bean because of pollen dehydration decreased number of pods per plants and number of grain per pods. Turk *et al.*, [9] reported that humidity decrease cause to decrease in grain yield and pod yield, as decrease grain weight. Therefore, the aim of this research was evaluation effect of water regimes and superabsorbent application on water productivity, growth characters and yield in tomato.

**MATERIAL AND METHODS**

The field experiment was conducted at Ahram region, Boushehr province, Iran in 2013. The soil was clay loamy, with a sand, silt, and clay composition of 32, 25, and 43%, respectively. The soil chemical analysis indicates: pH at 7.9 and estimated the following nutrients in their available form: 0.20 (%) N, 9.8 ppm P, 175 ppm K, O.M. = 1.8 %. This experiment was carried out at split plot in randomized complete block design with...
three replications. Irrigation region in three levels including (30, 50 and 70% discharge of available moisture content) as main plots and five humidity superabsorbent including (0, 0.25, 0.5, 0.75 and 1% by weight) as sub plots.

According to the authorities, the time to measure water evaporation from pan evaporation was 50 mm. Three rows of each plot was planted tomato with a distance of 1 m. row space was 0.5 m, number of plant per row was 9 numbers and number of plant per plot was 27 numbers. Nitrogen, phosphorous and potassium fertilizers were used at the rates of N 200 kg ha⁻¹ urea, P₂O₅ 100 kg ha⁻¹ triple superphosphate and K₂O 100 kg ha⁻¹ potassium sulphate. Nitrogen topdressing was carried out 30 days after transplanting and three week after first top dress. Similarly, identical in all treatments weed control was same. Other agricultural operations were conducted according to the principles of tomato crops. The data were analyzed using with SAS (version 6.12) and the procedures were described by SAS. The measurements of treatments were compared and grouped using Duncan's multiple range tests at the 0.05 significance level.

RESULTS AND DISCUSSION

Number of fruits per plant: This trait was significant only at interaction of water regime in superabsorbent in 1% probability level (Table 1). Mean comparison at interaction showed that the maximum number of fruits per plant was obtained at interaction of 30% discharge of available moisture content and 0.75% superabsorbent application (58 numbers), interaction of 50% discharge of available moisture content and 0.25% superabsorbent application. The least number of fruits per plant had performance at interaction of 30% discharge of available moisture content and 0.50% superabsorbent application (52 numbers) and interaction of 50% discharge of available moisture content and 0.25% superabsorbent application (Fig 1).

![Fig. 1: Interaction of irrigation regime and superabsorbent application on number of fruit per plant.](image)

**Fruit weight:**
Fruit weight on the statistically was effect by water regime and superabsorbent in 5 probability level (Table 1). Mean comparison of main effect showed that the highest fruit weight equal to 86.4 and 86.6 g was observed for 30 and 70% discharge of available moisture content, the least fruit weight (85.4 g) was obtained in 50% discharge of available moisture content (Fig 2). Mean comparison of superabsorbent showed that the maximum fruit weight equal to 87.67 g was produced with 0.5% weight superabsorbent application and the minimum fruit weight was observed with 0.25, 0.75 and 1% by weight superabsorbent application equal to 85.78 g (Fig 3).

![Fig. 2: Mean comparison of irrigation regime on fruit weight.](image)
Fruit length:
This character only effect by superabsorbent in 5% probability level (Table 1). The most fruit length equal to 45.11 mm had obtained with 0.75% weighty of superabsorbent application and lowest of that equal to 42.22 and 42.33 mm in control treatment and 0.75 weighty of superabsorbent application. As, fruit length for 0.5 and 1% superabsorbent application was 43.78 and 43.56 mm that was in same statistically range (Fig 4).

Fruit diameter:
This parameter was significant by superabsorbent application and interaction of irrigation regime and superabsorbent application in 5% probability level (Table 1). This trait with 1% weighty of superabsorbent application had the most rank (53.22 mm) and for control treatment and 0.25 and 0.5% weighty of superabsorbent application was 51.11, 51.22 and 51 mm, respectively (Fig 5). At interaction of irrigation regime and superabsorbent application the most fruit diameter equal to 56.67 mm was performance at interaction of 50% discharge of available moisture content and 1% weighty of superabsorbent application. The least fruit diameter was observed at interaction of 50% discharge of available moisture content and 0.25% weighty of superabsorbent application (50.33 mm) and 70% discharge of available moisture content with all superabsorbent levels equal to 50.33, 50.33, 49.67 and 50.33 mm, respectively (Fig 6).
Fig. 6: Interaction of irrigation regime and superabsorbent application on fruit diameter.

Table 1: Mean square of growth character under irrigation regime and superabsorbent in tomato.

<table>
<thead>
<tr>
<th>S.O.V.</th>
<th>DF</th>
<th>Number of fruit per plant</th>
<th>Fruit weight</th>
<th>Fruit length</th>
<th>Fruit diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rep</td>
<td>2</td>
<td>35.82</td>
<td>20.47</td>
<td>13.07</td>
<td>46.87</td>
</tr>
<tr>
<td>Irrigation (I)</td>
<td>2</td>
<td>6.29</td>
<td>26.20</td>
<td>5.60</td>
<td>32.60</td>
</tr>
<tr>
<td>Error</td>
<td></td>
<td></td>
<td>14.99</td>
<td>16.07</td>
<td>32.57</td>
</tr>
<tr>
<td>Superabsorbent (S)</td>
<td>4</td>
<td>8.31</td>
<td>36.26</td>
<td>26.74</td>
<td>18.74</td>
</tr>
<tr>
<td>IS</td>
<td>8</td>
<td>40.34</td>
<td>23.78</td>
<td>5.71</td>
<td>17.04</td>
</tr>
<tr>
<td>Error</td>
<td>24</td>
<td>19.18</td>
<td>16.73</td>
<td>8.29</td>
<td>6.78</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td></td>
<td></td>
<td>8.02</td>
<td>4.75</td>
<td>6.66</td>
</tr>
</tbody>
</table>

** and * significant in 1% and 5% level, respectively

Water use:
This index was significantly effect by irrigation regime in 5% probability level (Table 2). The most water use for plant had observed with 30 and 50% discharge of available moisture content (3538 and 3443 m³/ha), and the minimum water use equal to 3176 m³/ha was observed in 70% discharge of available moisture content (Fig 7).

Fig. 7: Mean comparison of irrigation regime on water use.

Water productivity:
This parameter only effect by irrigation regime in 5% probability level (Table 2). Mean comparison of irrigation regime showed that the highest water productivity equal to 8.9 kg/m³ with 70% discharge of available moisture content (Fig 8).

Fig. 8: Mean comparison of irrigation regime on water productivity.
Yield:

Final plant yield was significantly effect by irrigation regime and superabsorbent application in 5% probability level (Table 2). Mean comparison showed that the most yield equal to 33273 and 32367 kg/ha was produced in 30 and 50% discharge of available moisture content (Fig 9). Mean comparison of superabsorbent application showed that the highest yield equal to 32811 kg/ha was performance in 1% weighty of superabsorbent application and the lowest yield equal to 29778 kg/ha was obtained in control treatment (Fig 10).

![Fig. 9: Mean comparison of irrigation regime on yield.](image)

![Fig. 10: Mean comparison of superabsorbent on yield.](image)

**Table 2: Mean square of yield and water parameters under irrigation regime and superabsorbent in tomato.**

<table>
<thead>
<tr>
<th>S.O.V.</th>
<th>DF</th>
<th>Water use</th>
<th>Water requirement</th>
<th>Water productivity</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rep</td>
<td>2</td>
<td>481901.36*</td>
<td>0.002*</td>
<td>1.91</td>
<td>65414888.89</td>
</tr>
<tr>
<td>Irrigation (I)</td>
<td>2</td>
<td>529024.36</td>
<td>0.0001</td>
<td>6.84</td>
<td>109854888.89</td>
</tr>
<tr>
<td>Error</td>
<td>4</td>
<td>129356.86</td>
<td>0.0001</td>
<td>2.08</td>
<td>40426555.56</td>
</tr>
<tr>
<td>Superabsorbent (S)</td>
<td>4</td>
<td>163973.86</td>
<td>0.0001</td>
<td>0.44</td>
<td>12551888.89</td>
</tr>
<tr>
<td>IS</td>
<td>8</td>
<td>56396.44</td>
<td>0.0001</td>
<td>1.31</td>
<td>9610722.22</td>
</tr>
<tr>
<td>Error</td>
<td>24</td>
<td>92724.33</td>
<td>0.0001</td>
<td>1.03</td>
<td>5224611.11</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>-</td>
<td>8.99</td>
<td>10.01</td>
<td>10.88</td>
<td>7.29</td>
</tr>
</tbody>
</table>

**and * significant in 1% and 5% level, respectively

In the process of transferring seedlings from the nursery to the field, in general some of them are not able to handle the transition affect the transition shocks die. Super absorbent core transferring seedlings to the cause of shock resulting from the transfer of the seedlings to endure and find of faster and better [6]. Water stored in case of dehydration in the material released in the soil and are used from plant roots [5]. Baghaei [1] reported that water stress in pollination stage and fertilization stage in bean because of pollen dehydration decreased number of pods per plants and number of grain per pods. With application of superabsorbent grain yield, 100 seed weight, harvest index, number of grain per pods and number of pods per plant had been significantly increased [7]. Turk et al., [9] reported that humidity decrease cause to decrease in grain yield and pod yield, as decrease grain weight.

REFERENCES


