ORIGINAL SCIENTIFIC PAPER

**Fertilization influence on productive performances of field-cultivated bitter gourd in western part of Romania**

Simona Crişan, Lucian Hălmăgean, Raul Ianchici

*Faculty of Food Engineering, Tourism and Environmental Protection, Aurel Vlaicu University of Arad, Elena Dragoi street 2, Arad, Romania (simo_crisan@yahoo.com)*

**Abstract**

Bitter gourd is a tropical plant with China or India as the most likely place of origin. Research aim was to determine the effect of different fertilization technologies on fruit yield of cultivated species on the climatic and soil conditions of the western part of Romania. During cultivation period, various fertilization technologies were applied: Cropcare 3 starter fertilization and Cropcare 3 starter fertilization+varied foliar fertilizations. Yield increases regarding to unfertilized control variants, were achieved by applying all fertilization recipes. The highest output was acquired by fertilizing, in the combined way Cropcare 3 starter fertilization+Nettle macerate foliar fertilization, for the crops established by planting in the first ten days of May (30,98 t·ha⁻¹).

Key words: *Momordica charantia* L., starter fertilization, foliar fertilization, yield

**Introduction**

*Momordica charantia* L. species, commonly known as bitter gourd, is a member of *Cucurbitaceae* family which presents a special therapeutic importance, being used since ancient times in Ayurvedic medicine and Tibetan zone. Although the seeds, leaves and vines all possess pharmaceutical uses, the fruit is the safest and most prevalent part of plant used as medicine in diabetes control (Assubaie N.F. and El-Garawany M.M., 2004). Taking into account the high requirements for warmth, bitter gourd is cultivated throughout tropical areas (South America, East and Central Africa, China, India) (Reyes et al., 1994). Unlike other cucurbits, it requires higher temperatures for obtaining major yields (Larkcom, 1991), but it is also more resistant when exposed at low temperatures (Desai and Musmade, 1998). If soil is highly fertile and prepared with enough organic matter, further nutrition of gourd may not be necessary (Larkcom, 1991). N:P:K applications of around 100:50:50 kg·ha⁻¹ are recommended by Robinson and Decker-Walters (1996). Nutritional contents in edible parts of bitter gourd plant can be improved by using N:P:K fertilizer during cultivation and plantation, observing an increase of proteins, vitamin C, total chlorophyll, chlorophyll A and B, nitrogen, phosphorous, potassium, copper, iron, manganese and zinc content (Assubaie N.F. and El-Garawany M.M., 2004).

Even if it is a tropical plant, positive results for fruit yield are also obtained in field-cultivation conditions in warmest areas of Romania. Such is the western part of the country, because of the Mediterranean climate and global warming influence.

**Material and methods**

Research was carried out during 2007 and 2008 in three different experimental locations from western part of Romania. In present paper there are presented the results obtained in Arad experimental site, characterized by a Eutric cambisol soil type. Biological material used as parts of experiments was obtained by employing bitter gourd seeds from Arad local population.
Land preparation included autumn deep ploughing and spring harrowing. Basic fertilization was accomplished in autumn, using organic manure (30 t·ha\(^{-1}\)) of decomposed manure incorporated by ploughing.

Field crops were established by planting the seedlings cultivated in pots in greenhouses, in three different periods: first ten days of May, second ten days of May and first ten days of June. Planting was manual with 40-45 days old seedlings and with 4-5 well formed leaves, obtaining a density of 14286 plants/ha. For supporting the plant, during vegetation a 2,2 m tall trellis was used.

At planting moment a starter fertilization was applied using a dose of 300 kg·ha\(^{-1}\) Cropcare 3 fertilizer. During cultivation period various fertilization technologies were applied: Cropcare 3 starter fertilization, Cropcare 3 starter fertilization + Volldunger Linz Classic 0,3% foliar fertilization, Cropcare 3 starter fertilization + Agriplant 2 0,6% foliar fertilization, Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization. Application interval for all foliar fertilizations was 10-14 days.

Cropcare 3 or Cropcare 10-10-20 is a complex mineral chlorineless fertilizer recommended both in starter and phasial fertilizations, especially for chlorine sensible, planted crops. Its chemical composition (%) is: N-10; P\(\text{O}_3\)-10; K\(\text{O}\)-20; CaO-4; MgO-4; S-11; B-0,15; Cu-0,1; Fe-0,1; Mn-0,7; Mo-0,01; Zn-0,1. Volldunger Linz Classic is an water soluble complex microelements fertilizer with following composition (%): N-14; P\(\text{O}_3\)-7; K\(\text{O}\)-21; MgO-1; microelements (B, Cu, Fe, Mn, Zn)-1. Agriplant 2 or Agriplant 12-5-24 is also an water soluble complex microelements fertilizer, used both for fertirrigation and foliar nutrition: N-12; P\(\text{O}_3\)-5; K\(\text{O}\)-24; MgO-2; B-0,01; Cu-0,01; Fe-0,05; Mn-0,05; Mo-0,001; Zn-0,01 (%). Nettle macerate was prepared as follows: plants were cut before flowering stage and water soaked (10 l water per 1 kg of nettle), letting the pot in the sun for 12-14 days and shaking solution in the morning and in the evening, for first three days; after filtering, obtained macerate was 1:20 water diluted and used for foliar nutrition.

Bifactorial experiment was 3 x 5 type with 15 variants. Experimental factors presented the following graduations: A factor – planting moment – a\(_1\) May1-3th, a\(_2\) May 18-20th and a\(_3\) June 4-6th; B factor – applied fertilization – b\(_1\) unfertilized, b\(_2\) Cropcare 3 starter fertilization, b\(_3\) Cropcare 3 starter fertilization + Volldunger Linz Classic 0,3% foliar fertilization, b\(_4\) Cropcare 3 starter fertilization + Agriplant 2 0,6% foliar fertilization, b\(_5\) Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization. Experiment was placed in belts arranged subdivided plots, for the 15 variants being performed three randomized repetitions.

For experimental data processing and interpretation it was used Analysis of Variance (ANOVA) statistical method (Saulescu and Saulescu, 1967). The significance of individual differences related with control values was determined using least significant difference (LSD) procedure and represented as follows: * - significant positive, ** - highly significant positive, *** - very highly significant positive and o-significant negative, oo - highly significant negative, ooo - very highly significant negative, respectively.

**Results and discussion**

Analyzing obtained yields, as an average for 2007 and 2008 experimental years (Graph 1), one can observe that the yield of bitter gourd fruit were influenced both of fertilization technology and planting moment.

Analyzing the influence of planting moment on fruit yield (Table 1), very highly significant results were determined by planting the seedling, both in the first ten days of May and in the second ten days of May, yield benefits relative to control Wt 1 (first ten days of June planting moment) being of 11,90 t·ha\(^{-1}\) and 7,51 t·ha\(^{-1}\), respectively.
Table 1. Influence of fertilization and planting moment on the yields of bitter gourd (Momordica charantia L.) fruit (2007-2008)

<table>
<thead>
<tr>
<th>Variant</th>
<th>A - Applied fertilization</th>
<th>B - Applied fertilization</th>
<th>Year</th>
<th>May 1-3th</th>
<th>May 18-20th</th>
<th>June 4-6th</th>
<th>Difference (t·ha⁻¹)</th>
<th>LSD (t·ha⁻¹)</th>
<th>%</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁</td>
<td>Unfertilized</td>
<td></td>
<td>2007</td>
<td>22,98</td>
<td>30,76</td>
<td>27,03</td>
<td>24,87</td>
<td>30,98</td>
<td>17,23</td>
<td></td>
</tr>
<tr>
<td>V₂</td>
<td>Cropcare 3 starter</td>
<td></td>
<td>2007</td>
<td>30,76</td>
<td>26,80</td>
<td>23,15</td>
<td>20,71</td>
<td>27,32</td>
<td>14,71</td>
<td>***</td>
</tr>
<tr>
<td>V₃</td>
<td>Cropcare 3 + Volldunger Linz</td>
<td></td>
<td>2007</td>
<td>27,03</td>
<td>23,15</td>
<td>20,71</td>
<td>17,23</td>
<td>21,66</td>
<td>13,84</td>
<td>***</td>
</tr>
<tr>
<td>V₄</td>
<td>Cropcare 3 + Agriplant 2</td>
<td></td>
<td>2007</td>
<td>24,87</td>
<td>19,44</td>
<td>12,41</td>
<td>9,01</td>
<td>18,91</td>
<td>10,97</td>
<td>***</td>
</tr>
<tr>
<td>V₅</td>
<td>Cropcare 3 + Nettle macerate</td>
<td></td>
<td>2007</td>
<td>30,98</td>
<td>20,98</td>
<td>12,41</td>
<td>9,01</td>
<td>21,66</td>
<td>14,71</td>
<td>***</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>2007</td>
<td>27,32</td>
<td>22,93</td>
<td>15,42</td>
<td>12,41</td>
<td>21,89</td>
<td>13,84</td>
<td></td>
</tr>
</tbody>
</table>

Applied fertilization resulted in the highest yield value of 26,01 t·ha⁻¹ at V₃ variant where was applied Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization, realizing in this way a very highly significant increase of 8,76 t·ha⁻¹ relative to control Wt 1 (unfertilized variant). By applying Cropcare 3 starter fertilization, a very highly significant yield increase of 8,07 t·ha⁻¹ relative to Wt 1 was also obtained, and a significant increase of 3,43 t·ha⁻¹ relative to variants average, control Wt 2. V₃ variant (Cropcare 3 starter fertilization + Volldunger Linz Classic 0,3% foliar fertilization) obtained a highly significant yield increase of 4,71 t·ha⁻¹ referring to Wt 1. The variant where was applied Cropcare 3 starter fertilization + Agriplant 2 0,6% foliar fertilization (V₄) lead to no significant difference, from the viewpoint of fruit yield, relative to Wt 1.
Regarding to combined action of the two studied factors, very highly significant yield increases of 7.78 t·ha⁻¹ and 8.00 t·ha⁻¹, 9.57 t·ha⁻¹ and 10.78 t·ha⁻¹, respectively, were obtained by applying both Cropcare 3 starter fertilization and Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization to crops planted in the first ten days of May and in the second ten days of May, respectively. Highly significant yield benefits of 6.87 t·ha⁻¹ and 7.50 t·ha⁻¹ were achieved when used same fertilization technologies at crops planted in the first ten days of June.

Related to control Wt 2 (variants average), significant positive yield differences of 3.87 t·ha⁻¹ and 5.08 t·ha⁻¹ were achieved only when planted the seedling in the second ten days of May and applied a starter fertilization with Cropcare 3 and a combined Cropcare 3 starter fertilization+Nettle macerate foliar fertilization, respectively. For the crops established by planting in the first ten days of May and in the first ten days of June, for all applied fertilizations, yield differences presented no significance regarding control Wt 2.

Conclusions

Bitter gourd (*Momordica charantia* L.) field-cultivation is possible in the soil and climatic conditions of western part of Romania. Best fruit yields were obtained, in both 2007 and 2008 experimental years, when planting method for crops establishment was used in the first ten days of May.

Yield increases relative to unfertilized control variants were achieved by applying various fertilization technologies, as follows: Cropcare 3 starter fertilization, Cropcare 3 starter fertilization + Volldunger Linz Classic 0.3% foliar fertilization, Cropcare 3 starter fertilization + Agriplant 2 0.6% foliar fertilization, Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization.

In both experimental years and also as their average, the highest fruit yields were acquired when applied Cropcare 3 starter fertilization and Cropcare 3 starter fertilization + water diluted 1:20 Nettle macerate foliar fertilization, respectively.

References


