Influence of variety and the type of cultivation (organic and conventional) on productivity, in four table grapes varieties, grown in Cluj county, Romania

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Abstract Four table grape varieties (Timpuriu de Cluj, Napoca, Chasselas dore, Muscat Hamburg) were tested in 2007, in Gherla, Cluj county, Romania, under two types of cultural practices: organic and conventional. The conventional system has comprised the use of two systemic fungicides: Ridomil gold MZ 68WP and Melody Duo 66.8 WP and two contact fungicides: Folpet 50 WP and Dithane M 45 in the interval may 3rd decade until June the 1st decade. The organic treatments were applied in the same interval with the following products: Bordeaux mixture 0,5% + purine of greater nettle fermented 1/20 dilution and copper sulphate 1% and at the end of the interval, with Bordeaux mixture 1% + soluble sulphur 0,4% and Trichodex 25 WP. In this study the following parameters were observed for the four table grape varieties: the number of grape clusters on vine stock, the average weight of the grapes, the absolute productivity index (API), the relative productivity index (RPI) and the grape production.

The experiment was a bifactorial one (type of culture x cultivar) with four table grape varieties grown in two types of culture systems (conventional and organic). The Napoca variety, cultivated in an organic system has registered higher values for three of the studied parameters (API, RPI and production) by comparison with values from the other three types in the conventional system, which suggests that there is a possibility of choice, from the present table types of cultivars with a high adaptability to the organic culture system.

The productivity of vine types is a complex characteristic, which depends on the genetic base of each type, on the environment conditions and the genotype and environment relation [8].

Older studies [6] or recent ones [2] have showed that a type of culture (organic or conventional) influences significantly the production, the manifestation of the main productivity elements (the number of grape clusters on the vine stock, the average weight of the grape) and the grape production.

The objective of this paper is to evaluate and to compare the productivity values and the productivity parameters, for the four types of table grapes analyzed, cultivated in two different systems: organic and conventional.

Materials and Method

The biological material used in this study was comprised by four types of table grape vines: Cluj Timpuriu, Napoca, Chasselas dore, Hamburg Muscat, tested in 2007, in Cluj county, observing the following parameters: the number of grape clusters on vine, the average weight of the grapes, the absolute and relative productivity and grape production.

Productivity was expressed through productivity indices:

API (absolute productivity index) = C.f.a x Wm
RPI (relative productivity index) = C.f.r x Wm,

where C.f.a and C.f.r. are absolute and relative productivity coefficients and Wm =average grape weight.

Average weight at full maturity was calculated by direct measurements of the bunch at 25 / repetition for each species separately and was expressed in grams. Production was calculated [7] as follows: Prod./ha = Prod./vine x Number of vines/ha.

How the placement experience was linear bifactorial type (type of culture x variety), and statistical interpretation of the results was made using Duncan test [1]. Types of culture were differentiated by treatment for diseases (especially downy mildew) for organic practices and for the conventional.

Conventional treatment consisted in the application of two systemic fungicides: Ridomil Gold MZ 68 WP and Melody Duo 66.8 WP and two
fungicides contact folpet 50 WP and Dithane M 45 in May 3rd decade - July 1st decade.

Organic treatments were applied in the same range with the following products: Bordeaux mixture 0.5% + spraying with purine of greater nettle fermented 1/20 dilution and copper sulphate 1% and at the end of the interval, Bordeaux mixture 1% + 0.4% soluble sulphur and Trichodex 25 WP.

**Results and Discussions**

Regarding the number of bunches/vine as can be seen from table 1 data, the influence of type of horticultural practice (organic or conventional) was insignificant in terms of average values for the four varieties.

### Influence of the type of cultivation and cultivars on number of bunches / vine

<table>
<thead>
<tr>
<th></th>
<th>Timpuriu de Cluj</th>
<th>Napoca</th>
<th>Chasselas dore</th>
<th>Muscat Hamburg</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact.A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td>11.0 b c</td>
<td>11.5 b</td>
<td>13.3 a</td>
<td>9.0 c d</td>
<td>11.2 A</td>
</tr>
<tr>
<td>Conventional</td>
<td>11.0 b c</td>
<td>12.5 a b</td>
<td>13.3 a</td>
<td>9.5 c d</td>
<td>11.6 A</td>
</tr>
<tr>
<td>Average B</td>
<td>11.0 N</td>
<td>12.0 M</td>
<td>13.3 M</td>
<td>9.3 P</td>
<td></td>
</tr>
</tbody>
</table>

DS 5% for two averages A (type of culture) = 0.69
DS for two averages B (variety) = 0.97 - 1.04
DS for two averages AxB (type of culture x variety) = 1.38 - 1.57

* = difference between two values followed by at least one common point is insignificant.

This is encouraging because it suggests that, at least in terms of number of bunches / vine, the four varieties have the same mode of behavior in conventional agriculture as in the organic one.

Regarding the influence of variety on the number of bunches/vine is notable as distinct variety Chasselas dore with an average of 13.3 character, with significant differences from the other three varieties. Variety has the least influence in the case of cultivar Muscat of Hamburg (9.3).

Analyzing data from the table of factors influence the interaction noted that the highest values are obtained from cultivation Chasselas dore with an average of 13.3 in terms of practical organic and conventional conditions of practice, followed with a very small difference Napoca variety with a number of bunch / vine of 12.5 recorded in conventional practices.

Variations resulted from other combinations (type of culture x variety) of varieties of Timpuriu de Cluj and Napoca (organic) values were almost equal, the differences are insignificant, and the variety Muscat Hamburg has recorded 9.0 bunch / vine significantly less than all other combinations.

Average weight (g) of the bunches of four varieties of vines for table grapes, studied in 2007, shows a significant difference between mean values recorded under the influence of the factor type of horticultural practice (organic or conventional), with a slightly higher, but significant difference for variations of the conventional practices, as presented in the following table (table 2).
Table 2

Influence of the type of cultivation and cultivars on average weight (g) / bunch

<table>
<thead>
<tr>
<th>Fact.B</th>
<th>Timpuriu de Cluj</th>
<th>Napoca</th>
<th>Chasselas dore</th>
<th>Muscat Hamburg</th>
<th>Average A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact.A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td>162.6 c d</td>
<td>237.2 b</td>
<td>144.0 d</td>
<td>240.4 b</td>
<td>196.0 B</td>
</tr>
<tr>
<td>Conventional</td>
<td>176.1 c</td>
<td>265.8 a</td>
<td>163.0 c d</td>
<td>256.6 a b</td>
<td>215.4 A</td>
</tr>
<tr>
<td>Average B</td>
<td>169.3 N</td>
<td>251.5 M</td>
<td>153.5 N</td>
<td>248.5 M</td>
<td></td>
</tr>
</tbody>
</table>

DS 5 % for two averages A (type of culture) = 9.58
DS for two averages B (variety) = 13.55 - 14.52
DS for two averages AxB (type of culture x variety) = 19.16 - 21.89

* = difference between two values followed by at least one common point is insignificant

Comparing the varieties, Napoca and Muscat Hamburg values (251.5 g and 248.5 g) are significantly higher than the other two varieties, Timpuriu de Cluj and Chasselas dore. Even if the variety Chasselas dore recorded the lowest value on the bunch weight, this is a normal and common value in other wine centers like Recas[5].

The interaction effect of the factors (type of culture x variety) on the values of this character, in every kind of media studied, indicates that this influence was significant in almost all comparisons made. The highest value recorded was for variety Napoca with 265.8 g in a conventional horticultural practice, followed by Hamburg and Muscat Napoca in the organic cultivation system, and the lowest values recorded were for varieties Timpuriu de Cluj and Chasselas dore (144 g).

The data on the API parameter, for the varieties analyzed, shows that the influence of horticultural practices (organic or conventional) is insignificant in terms of the values for the four varieties, according to table 3.

Table 3

The influence of the type of cultivation and cultivars on absolute productivity index(API)

<table>
<thead>
<tr>
<th>Fact.B</th>
<th>Timpuriu de Cluj</th>
<th>Napoca</th>
<th>Chasselas dore</th>
<th>Muscat Hamburg</th>
<th>Average A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact.A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td>309.8 c d</td>
<td>531.8 a</td>
<td>171.7 h</td>
<td>262.7 e</td>
<td>319.0 A</td>
</tr>
<tr>
<td>Conventional</td>
<td>255.7 f</td>
<td>502.1 b</td>
<td>215.3 g</td>
<td>307.3 d</td>
<td>320.1 A</td>
</tr>
<tr>
<td>Average B</td>
<td>282.7 N</td>
<td>516.9 M</td>
<td>193.5 P</td>
<td>285.0 N</td>
<td></td>
</tr>
</tbody>
</table>

DS 5 % for two averages A (type of culture) = 1.82
DS for two averages B (variety) = 2.58 - 2.76
DS for two averages AxB (type of culture x variety) = 3.64 - 4.16

* = difference between two values followed by at least one common point is insignificant

The result can be considered as positive because, regarding the organic farmers, it means that they will not lose too much in terms of grape production.

Regarding the influence of variety on the API, the Napoca variety is notable with the highest value (531.8) recorded in the organic type culture. Of the other three varieties, two (Muscat Hamburg and Timpuriu de Cluj) are equal in terms of statistically significant differences and recorded before the
Chasselas dore, whose value API = 215.3 recorded at Gherla in 2007 is very close to the API = 228.1 recorded in 2001 in terms of S.D. Timişoara [4].

Analysis of the interaction of factors (type of culture x variety) on the API, shows that this influence was significant in all possible combinations. The only relatively equal values of the statistical variations are recorded at the Timpuriu de Cluj (organic) with API = 309.8 and Muscat Hamburg (conventional) with API = 307.3, the remaining variants present significant differences between any two of these comparisons.

Table 4

**Influence the type of cultivation and cultivars on index of relative productivity (RPI)**

<table>
<thead>
<tr>
<th>Fact.B</th>
<th>Timpuriu de Cluj</th>
<th>Napoca</th>
<th>Chasselas dore</th>
<th>Muscat Hamburg</th>
<th>Average A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
<td>150.4 g</td>
<td>441.5 a</td>
<td>130.2 h</td>
<td>219.3 d</td>
<td>235.4 B</td>
</tr>
<tr>
<td>Conventional</td>
<td>184.6 e</td>
<td>376.7 b</td>
<td>169.3 f</td>
<td>242.2 c</td>
<td>243.2 A</td>
</tr>
<tr>
<td>Average B</td>
<td>167.5 P</td>
<td>409.1 M</td>
<td>149.8 R</td>
<td>230.7 N</td>
<td></td>
</tr>
</tbody>
</table>

DS 5 % for two averages A (type of culture) = 0.43
DS for two averages B (variety) = 0.61 - 0.65
DS for two averages AxB (type of culture x variety) = 0.86 - 0.98

* = difference between two values followed by at least one common point is insignificant

If we look at the data in table 4 which represents the experimental data synthesis RPI, we can say without mistake in this case that all values reported significant differences for all factors of influence: type of culture (organic or conventional), variety and interaction of factors (type of crop x variety).

Any two comparisons possible in this case do not present equal values in terms of relative productivity index. It should be noted however that, in this case also, the variety Napoca has the greatest values of RPI. For this variety in the organic system the RPI = 441.5 and for conventional system RPI = 376.7, indices which are significantly superior to those in the variety Chasselas dore (130.2) and the variety of Cluj Timpuriu (150.4) in organic system of cultivation.

Data on production of the four varieties studied in Gherla village, Cluj county, in 2007 are presented in table 5.

Table 5

**The influence of the type of cultivation and cultivars on grape production (t / ha)**

<table>
<thead>
<tr>
<th>Fact.B</th>
<th>Timpuriu de Cluj</th>
<th>Napoca</th>
<th>Chasselas dore</th>
<th>Muscat Hamburg</th>
<th>Average A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
<td>7.5 e</td>
<td>11.3 b</td>
<td>7.9 e</td>
<td>9.0 c</td>
<td>8.9 B</td>
</tr>
<tr>
<td>Conventional</td>
<td>8.1 d</td>
<td>13.8 a</td>
<td>8.8 c d</td>
<td>10.1 b c</td>
<td>10.2 A</td>
</tr>
<tr>
<td>Average B</td>
<td>7.8 P</td>
<td>12.6 M</td>
<td>8.4 P</td>
<td>9.6 N</td>
<td></td>
</tr>
</tbody>
</table>

DS 5 % for two averages A (type of culture) = 0.68
DS for two averages B (variety) = 0.96 - 1.03
DS for two averages AxB (type of culture x variety) = 1.36 - 1.55

* = difference between two values followed by at least one common point is insignificant

It is noted that the influence of the type of agriculture (organic or conventional) influenced significantly the average production from the four varieties. The value of 10.2 t / ha, representing the
average of the varieties in conventional horticultural practices, is significantly higher compared with the average 8.9 t/ha of the four varieties in organic culture. The influence of variety on production highlights the high production variety Napoca (12.6 t/ha), it is located on the first place, the significant differences from the other three varieties, indicating that in Timpuriu de Cluj, with 7.8 t/ha and Chasselas dore with 8.4 t/ha have equal amounts averages from a statistical viewpoint. Muscat Hamburg with 9.6 t/ha is in second place after the variety Napoca with a significant difference, values that are found in research carried out [3] in the vineyards of Recas, where the value of the variety Muscat Hamburg was 10.98 t/ha.

The interaction of factors upon production indicates that, under conventional practice horticultural variety Napoca achieved the highest production 13.8 t/ha, followed with a significant difference still by Napoca, but in an organic culture, with a production of 11.3 t/ha. The lower production was recorded for the Timpuriu de Cluj variety (7.5 t/ha) under organic cultivation.

Conclusions

1. For most characters studied there is a significant influence of type of culture on the manifestation of those characters.
2. In the case of two characters (bunch numbers/vine and API) between the two systems of culture are no significant differences. This is encouraging because it suggests that the four table grapes varieties react identical to systems seriously differentiated in terms of the disease.
3. Among the varieties of table grapes, Napoca is remarked by far, for most characters studied, here were found highest values regardless of the type of culture considered. The finding is encouraging because, from the outset it indicates a variety of vine for table grapes with great possibilities for adaptation to organic growing systems.

References

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