INFLUENCE OF CULTURE SYSTEM ON PRODUCTION AT SOME GRAFTED TOMATO CULTIVARES

INFLUENȚA SISTEMULUI DE CULTURĂ ASUPRA PRODUCȚIEI LA UNELE CULTIVARE DE TOMATE ALTOITE

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Abstract. *The research has watched the influence of the culture system on the production at some grafted tomato cultivares. The experimental variants were grafted tomatoes: 'Alambra'/'Titron', 'Alambra'/'Beaufort', 'Alambra'/'Suketto', 'Alambra'/'Konkurabe', 'Cypriana'/'Titron', 'Cypriana'/'Beaufort', 'Cypriana'/'Suketto' and 'Cypriana'/'Konkurabe' grown at a density of 12000 and 15000 plants / ha and ungrafted tomatoes (control): 'Alambra' and 'Cypriana', grown at a density 24000 plants / ha. The culture system at grafted plants was with one and two stalks, at ungrafted plants was with one stalk. Were made determinations, observations and interpretations regarding the influence of the culture system on the production (quantity - t/ha, quality - SR 1421/2003 and earliness – days between planting and first harvest). The best results at quantity were obtained from grafted tomatoes with two stalks, then ungrafted tomatoes and grafted tomatoes conducted with a stalks; at commercial quality, grafted tomatoes were superior. At earliness, the grafted plants were late compared with the ungrafted plants. The culture system of the grafted tomatoes influence the production.*
Key words: *grafting, harvest, Lycopersicon esculentum, technology*

Rezumat. *Cercetarea a urmărit influența sistemului de cultură asupra producției la unele cultivare de tomate altoite. Variantele experimentale au fost tomate altoite: 'Alambra'/'Titron', 'Alambra'/'Beaufort', 'Alambra'/'Suketto', 'Alambra'/'Konkurabe', 'Cypriana'/'Titron', 'Cypriana'/'Beaufort', 'Cypriana'/'Suketto' şi 'Cypriana'/'Konkurabe', cultivate la o densitate de 12000 şi 15000 plante/ha şi tomate nealtoite (martor): 'Alambra' şi 'Cypriana', cultivate la o densitate de 24000 plante/ha. Sistemul de conducere la plantele altoite a fost cu unul şi două brațe, la plantele nealtoite a fost cu un braț. S-au realizat determinări, observații şi interpretări privind influența sistemului de cultură asupra producției (cantitate – t/ha, calitate – conform SR 1421/2003 şi timpurietate - număr de zile intre plantare şi prima recoltare). Cele mai bune rezultate la cantitatea de fructe le-au obținut tomatele altoite conduse cu două brațe, apoi tomatele nealtoite şi tomatele altoite conduse cu un braț; la calitatea comercială, tomatele altoite au fost superioare comparativ cu tomatele nealtoite. La timpurietate, plantele altoite au fost mai tardive comparativ cu plantele nealtoite. Sistemul de cultură al tomatelor altoite influențează producția.*
Cuvinte cheie: *altoire, Lycopersicon esculentum, recoltă, tehnologie*

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INTRODUCTION

The seedlings quality is decisive to ensuring economic efficiency and environmental protection (Dobrin, 2005).The technology for greenhouse tomato production by using of grafted plants is great success all over the world (Japan, Korea, USA, Turkey, Morocco) and in Europe (Italy, Greece etc.) is a tradition in this domain. The modern protected cultures are established by grafted seedlings and its have a higher spread both world and in our country because its have numerous advantages (Iliescu, 2013).

The researches on the vegetable crops grafted have started and in the Researchand Development Institute for Processing and Marketing of Horticultural Products – Horting, Bucharest, Romania in 2002 and continues and today.The researchers showed that grafting improves absorption of water and nutrients (King *et al.,* 2010, Lee 1994). The results on the fruit quality from grafted plants are contradictory (Davis *et al.,* 2008, cited by Doltu. and Bogoescu, 2014).

The researchers from the Institute Horting Bucharest have showed that the grafting influences the production and the earliness of first harvest of eggplants (Doltu and Bogoescu, 2014) studying these aspects at all the vegetables that are grafted.

MATERIAL AND METHOD

The plants used for grafting have been tomato rootstocks, three F_1 hybrids, 'Titron', 'Beaufort', 'Suketto', 'Konkurabe' and scion, two F_1 hybrids of tomatoes, 'Alambra' and 'Cypriana'.

The experimental variants were grafted tomatoes, so: 'Alambra'/'Titron', 'Alambra'/'Beaufort', 'Alambra'/'Suketto', 'Alambra'/'Konkurabe', 'Cypriana'/'Titron', 'Cypriana'/'Beaufort', 'Cypriana'/'Suketto' and 'Cypriana'/'Konkurabe' cultured at a density of 12000 and 15000 plants/ha and ungrafted tomatoes (control): 'Alambra' and 'Cypriana', cultured at a densiy of 24000 plants/ha. The directing system of the grafted plants was with one arm and two arms and with one arm at the ungrafted plants.

Were made determinations, observations and interpretations regarding the influence of the culture system on the production (quantity - t/ha, quality - according to SR 1421/2003 and earliness - number of days between planting and first harvest).

Duncan test was used for statistical interpretations of the results and the determination coefficient.

RESULTS AND DISCUSSIONS

The results on the influence of the culture system on the quantity of tomato fruits/ha is the average from three years of research; the results are presented in Table 1.

From analysis of productions on variants - grafted combinations and variants - ungrafted plants were found higher productions at combinations scion/rootstock: 'Alambra' F_1/'Beaufort' (67.00 t/ha), 'Alambra' F_1/'Titron' (65.75 t/ha), 'Alambra' F_1/'Konkurabe' (64.75 t/ha), 'Alambra' F_1/'Suketto' (63.25 t/ha). King *et al.,* 2010 and Lee 1994 confirms higher productions at grafted plants compared with ungrafted plants.

Table 1

The influence of the culture system on tomato production (t/ha)

Combination scion x rootstock	Mt.	B1.1	B1.2	B2.1	B2.2	$\bar{X}$
'Alambra'/'Titron'		55	86	51	71	**65.75**
'Cypriana'/'Titron'		55	84	51	63	**63.25**
'Alambra'/'Beaufort'		56	88	52	72	**67.00**
'Cypriana'/'Beaufort'		54	85	50	64	**63.25**
'Alambra'/'Konkurabe'		55	85	49	70	**64.75**
'Cypriana'/'Konkurabe'		53	83	47	62	**61.25**
'Alambra'/'Suketto'		52	84	47	70	**63.25**
'Cypriana'/'Suketto'		52	81	45	64	**60.50**
$\bar{x}$ **(grafted)**		**54.0**	**84.5**	**49.0**	**67.0**	***63.62***
'Alambra'	69					**69.0**
'Cypriana'	62					**62.0**
$\bar{x}$ **(ungrafted)**	**65.5**					***65.5***

It is noted that the scion has influenced the production per hectare, 'Alambra' had higher productions, grafted on all rootstocks, compared with the scion 'Cypriana', a maximum production at the combination 'Cypriana' F_1/'Titron' (63.25 t/ha), this is the minimum obtained at a combination of the 'Alambra' scion - 'Alambra' F_1/'Suketto' (63.25 t/ha). And Palada and Wu, 2005 underlines in his papers the high productions of the grafted plants compared with the plants ungrafted.

Regarding the influence of the conducting system on the production, were evidenced by a higher yield the variants of grafted plants with two stalks at density of 15000 plants/ha (84.5 t/ha) and at density of 12000 plants/ha (67.0 t/ha), compared with control variants – ungrafted plants – which recorded average yield lower (65.5 t/ha). It can be noted higher production at ungrafted variants – 'Alambra' and 'Cypriana' (65.5 t/ha) compared with grafted variants with one stalks (49-54 t/ha). The average productions were interpreted by Duncan test (Fig. 1).

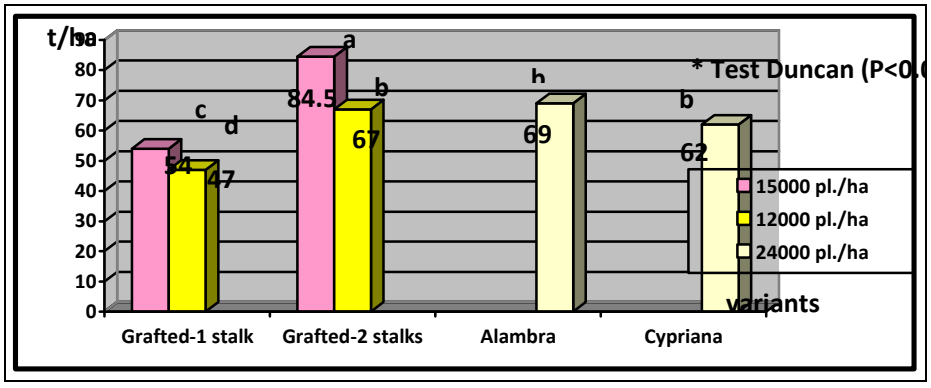

Fig. 1 -Statistical interpretation of production (t/ha)

Differences between variants are significant, exception the ungrafted variants and 'Alambra' - grafted, two stalks and 12000 plants/ha. Reducing of the density/ha decreases the tomato quantity/ha.

In order to determine the influence of the culture system on the occurrence of the first crop (degree of earliness) were conducted observations and measurements (date of the first crop, number of days from planting to first harvest) (Table 2).

Table 2

Earliness of tomato culture
(date of the first crop, number of days from planting to first harvest)

Combination scion /rootstock	Control		B1.1		B1.2		B2.1		B2.2		$\bar{x}$
	Day	No. of days	Day	No. of days	Day	No. of days	Day	No. of days	Day	No. of days	Day
'Alambra' / 'Titron'			01.09	88	31.08	87	30.09	86	31.08	87	87.00
'Cypriana' / 'Titron'			02.09	89	02.09	89	01.09	88	31.08	87	88.25
'Alambra' / 'Beaufort'			31.08	87	01.09	88	31.09	87	31.08	87	88.25
'Cypriana' / 'Beaufort'			02.09	89	02.09	89	02.09	89	01.09	88	88.75
'Alambra' / 'Konkurabe'			01.09	88	31.08	87	31.08	87	30.08	86	87.00
'Cypriana' / 'Konkurabe'			02.09	89	02.09	89	02.09	89	01.09	88	88.75
'Alambra' / 'Suketto'			02.09	89	31.08	87	01.09	88	01.09	88	88.00
'Cypriana' / 'Suketto'			03.09	90	03.09	90	02.09	89	02.09	89	89.50
$\bar{x}$ **grafted**				88.6		88.3		87.8		87,5	*88.05*
'Alambra'	25.08	81									
'Cypriana'	29.08	82									
$\bar{x}$ **ungrafted**		**81.5**									***81.50***

It is clear that the grafted tomato variants were tardive as 6-7 days compared with the ungrafted tomato variants.

The precocity of the ungrafted tomatoes compared with the grafted tomatoes is signaled and from other specialists (Doltu *et al,* 2012) in scientific papers. The time differences between combinations (rootstock x scion) have varied between 87 days ('Alambra' F_1 /'Titron', 'Alambra' F_1 /'Konkurabe') and 89.50 days ('Cypriana' F_1 /'Suketto'). The conducting system of the strain and density per unit area have influenced little the precocity production, the differences were not significant, the days number from planting to first harvest has varied between 87.5-88.6 days ($\bar{x}$ = 88.05 days) at grafted plants and between 81-82 days ($\bar{x}$ = 81.5 days) at ungrafted plants.

Regarding the influence of the culture system on the percentage of Extra and Ist category fruits at the tomato crop, the differences between cultivars or

combinations (scion x rootstock) were not significant (Table 3). The fruit quality was appreciated in accordance with the quality standards for fresh fruits and vegetables SR 1421/2003, for tomatoes.

Table 3

Influence of the culture system on quality, Extra and Ist category (%)

Variants	Control	B1.1	B1.2	B2.1	B2.2	$\bar{x}$
'Alambra' / 'Titron'		85.7	84.1	85.8	84.5	85.0
'Cypriana' / 'Titron'		85.3	83.8	85.1	84.1	84.6
'Alambra' / 'Beaufort'		86.2	84.4	86.3	84.8	85.4
'Cypriana' / 'Beaufort'		85.2	84.1	85.4	84.3	84.8
'Alambra' / 'Konkurabe'		84.4	83.9	84.8	84.1	84.3
'Cypriana' / 'Konkurabe'		84.1	83.8	84.5	83.8	84.0
'Alambra' / 'Suketto'		84.7	84.0	84.7	84.1	84.4
'Cypriana' / 'Suketto'		84.2	83.7	84.5	83.6	84.0
$\bar{x}$ **grafted plants**		85.0	84.0	85.1	84.2	*84.6*
'Alambra'	80.9					80.9
'Cypriana'	80.4					80.4
$\bar{x}$ **ungrafted plants**	**80.7**					***80.7***

At density 15000 plants/ha were obtained 85-85.1% of extra and Ist category fruits; at density 12000 plants/ha were obtained 84-84.2% of Extra and Ist category fruits. Regarding the culture system with one stalk, the Extra and Ist category fruits were 84-85% and at culture system with two stalks were between 84.2-85.1%. Analysis of data presented show a high commercial quality of tomato fruits from grafted cultures, 84.6% (Extra and Ist fruits) compared with ungrafted cultures, 80.7% (Extra and Ist) .

Correlations between the culture system (number of stalks/plant) and production and fruit quality

In Figure 3 is observed a direct linear correlation between the culture system (number of stalks/plant) and parameters concerning production. The value of the determination coefficient shows that at average production per hectar the correlation significance is strong, very significant ($r^2 = 1$).

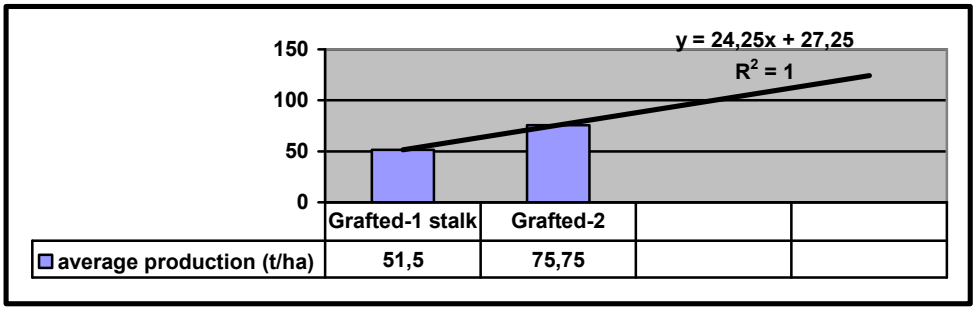

Fig. 3 - Influence of culture system (no. of stalks/plants) on production

In Figure 4, it is noted that there is a indirect linear correlation between number of stalks/plant and parameters of fruit quality (Extra and a I-a category).

The value of the determination coefficient shows that at number of stalks/plant, the correlation significance the correlation significance (r^2 = 0,9044).

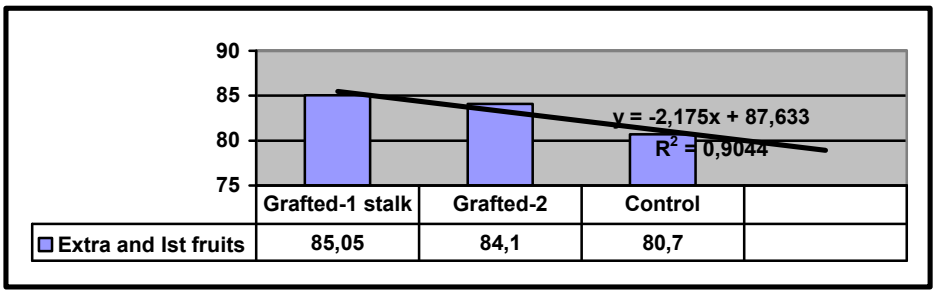

Fig. 4 - Influence of culture system (no. of stalks/plants) on tomato quality

CONCLUSIONS

1. The cultivars scions and rootstocks researched had compatibility by grafting, in order to achieve the desired results (quantity and quality).

2. The grafting induce a slight tardiness.

3. The density per area unit and the culture system influences the production; best results are obtained with a density of plants at half compared with ungrafted cultivars and culture system with two stalks/plant.

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