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THE ROOTSTOCK EFFECT IN WATERMELON PRODUCTION

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ABSTRACT - The rootstock effect in watermelon production
Watermelon production has a great tradition in Hungary. The experiment was set up at Medgyesegyháza Békés county in 2010, in cooperation with the company TÉSZ-ÉSZ Nonprofit Kft. Combination of 4 container watermelon varieties *Lonci*, *Crimstar*, *Sprinter* and *Early Beauty* and squash rootstocks of 2 different variety groups (*Lagenaria* and interspecific) were tested. Non-grafted and grafted plants, in accordance with the commonly used method of production, were planted out at different plant spacings in 4 repeats, meaning that non-grafted transplants were placed at a row width and plant spacing of 2.7 x 0.5 m (0.74 plants per m^2) while grafted plants at 2.7 x 1 m (0.37 plants per m^2). Using the results obtained, average yield per m^2 was determined, as well as average fruit weight and yield per plant. At the pickings it was seen that the extremely wet and cool growing season had produced different effect on the disease susceptibility of the different graft combinations. On July 31st 2010, each graft combination was surveyed for its foliage using a scale ranging from 1 to 5 where the value 1 represented the greatest foliage loss. In the trial the container varieties were found to be preferably grafted onto rootstocks belonging to the *Lagenaria* type. The variety *Argentario*, tested also in the trial, is recommended.

Keywords: watermelon, grafting, yield, varieties, foliage

INTRODUCTION

Watermelon production has a great tradition in Hungary. Descriptions on its cultivation appeared as early as the 18th century, which show that at that time it was one of the most important articles of provision. By the present days, the grafting of watermelon has gained in importance. Due to the extreme weather characteristics of the country, a further considerable increase in the area of grafted plants is expected.
In order to select the suitable combination of rootstock and scion variety it is necessary to know the characteristics of the rootstock: the type of root system, resistance, its effect on growth vigour and its effect on fruit ripening etc. As many as 6 to 7 varieties can be considered for melon rootstock. In Asia, grafted vegetables had already been brought into cultivation several centuries ago (LEE-ODA 2003). In Korea and in Japan grafted watermelon transplants were produced on a large scale already in 1920 (LEE 1994), but their use in production in the Western world started only from 2005 onwards (RISTAINO, THOMAS 1997). The reason for using grafted transplants consisted in the protection against soil borne pests and diseases, as chemical and genetic methods had failed to reach the desired effect (ODA 2002). Grafted transplants show a better reaction to novel diseases besides offering a cheaper and more flexible solution compared to the development of a resistant variety by breeding. Simultaneously, it can assist in the improvement of quality and yields (LEE-ODA, 2003, NISINI ET AL., 2002, ODA, 2002, RIVERO ET AL., 2003, ROMERO ET AL., 1997, SHIMADA-MORITANI 1977; YETISIR-SARI, 2003; TRAKA-MAROVNA ET AL., 2000).

Nowadays, many other reasons exist for the use of grafting, e.g. to make use of the resistance of grafted plants to low and high temperatures, of the increased salt tolerance, of the increased absorption and of the more efficient use of water (COHEN-NOAR, 2002). Due to the importance of the subject, the aim of the experiment was to study the quantitative and qualitative changes in response to grafting. Besides measuring the quantitative and qualitative parameters we also wanted to see what differences could be observed between the interspecific and *Laganaria* types.

MATERIAL AND METHOD

The experiment was set up at Medgyesegyháza Békés county in 2010, in cooperation with the company TÉSZ-ÉSZ Nonprofit Kft. Combination of 4 container watermelon varieties *Lonci*, *Crimstar*, *Sprinter* and *Early Beauty* and squash rootstocks of 2 different variety groups (*Lagenaria* and interspecific) were tested. The interspecific squash rootstock was represented by the varieties *Nimbus*, *Carnivor* and *Titán*, while the Bottle gourd (*Lagenaria*) variety type by the varieties *Argentario* and *Macis*. Seeds of the non-grafted melon used as the control and those of the rootstocks were sown on March 16th and grafting took place on April 13th. Outplanting in the field was carried out on April 30th using an intensive technology (soil mulch, dripping tube, readily water soluble fertilizer, small plastic tunnel). Non-grafted and grafted plants, in accordance with the commonly used method of production, were planted out at different plant spacings in 4 repeats, meaning that non-grafted transplants were placed at a row width and plant spacing of 2.7 x 0.5 m (0.74 plants per m^2) while grafted 2.7 x 1 m (0.37 plants per m^2). In the phase of intensive development, growth vigour was recorded on June 17th 2010, where the growth vigour of the different grafted plants was compared to one another. After ripening, using a digital scale, the fruits were weighed individually for each treatment and for each repeat in the treatment. Using the results obtained, average yield per m^2 was determined, as well as average fruit weight and yield per plant. At the pickings it was seen that the extremely wet and cool growing season had produced different effect on the disease susceptibility of the different graft combinations. On July 31st 2010, each graft combination was surveyed for its foliage using a scale ranging from 1 to 5 where the value 1 represented the greatest foliage loss.

RESULTS

On June 17th 2010 the growth vigour of all the plants was measured using a scale ranging from 1 to 5. Of the grafted plants the graft combinations *Crimstar* x *Argentario*, *Crimstar* x *Macis* and *Sprinter* x *Argentario* had the same growth vigour.
Based on the results, it can be seen that the rootstocks belonging to the *Lagenaria* type had stronger growth vigour than the ones belonging to the interspecific group. Except for the own-rooted *Crimstar*, all the three non-grafted varieties are characterized by weaker growth vigour than the grafted variants. In the case of the *Crimstar* the plants grafted onto the rootstock *Nimbus* showed weaker growth vigour than the non-grafted plants (*Figure 1*).

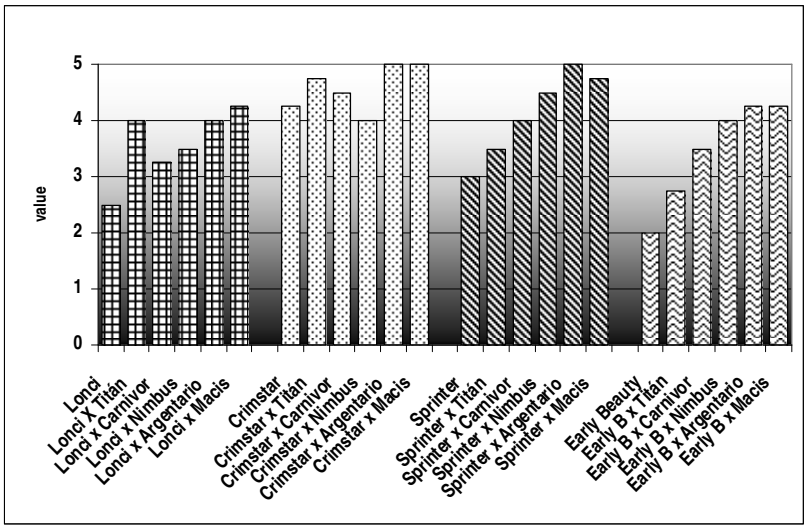

Figure 1: Growth vigour of grafted watermelon (2010)

Fruits were harvested with 5 pickings (July 26th, July 29th, August 3rd, August 10th and August 18th). In the case of the varieties *Lonci*, *Sprinter* and *Early Beauty* it was seen that grafting had increased yields per m^2 in all the cases. With each combination tested the highest value was measured for the variety *Argentario* belonging to the *Lagenaria* genus. In the case of *Crimstar*, grafting had no yield increasing effect in most of the cases, except when grafted onto the rootstock *Argentario*. In the case of the varieties *Lonci*, *Crimstar* and *Early Beauty* the bottle gourd rootstocks are capable of producing higher yields than the interspecific squash varieties. Grafting had a yield enhancing effect on average fruit weight in all of the cases, as well as increasing yields per plant (*Table 1*).

Table 1. Yield parameters of grafted watermelons (2010)

Varieties and graft combinations	Average yield kg/m^2	Average weigh kg/pc	Yield pc/plant
Lonci	3,55	3,99	1,15
Lonci x *Titán*	9,25	**7,42**	3,43
Lonci x *Carnivor*	8,21	5,82	3,73
Lonci x *Nimbus*	9,08	6,84	3,62
Lonci x *Argentario*	**12,35**	6,70	**4,97**
Lonci x *Macis*	10,45	6,90	4,10
Crimstar	10,29	5,31	2,70
Crimstar x *Titán*	7,49	5,82	3,56
Crimstar *Carnivor*	7,94	5,38	3,92
Crimstar x *Nimbus*	8,11	5,93	3,78
Crimstar x *Argentario*	**12,70**	**6,13**	**5,70**
Crimstar x *Macis*	8,22	6,00	3,67
Sprinter	3,24	3,90	1,13
Sprinter x *Titán*	8,13	**7,31**	3,00
Sprinter x *Carnivor*	9,31	6,42	3,89
Sprinter x *Nimbus*	9,14	6,58	3,83
Sprinter x *Argentario*	**11,47**	6,14	**5,02**
Sprinter x *Macis*	6,93	5,83	3,24
Early Beauty	3,84	4,78	1,09
Early Beauty x *Titán*	6,58	**5,86**	3,00
Early Beauty x *Carnivor*	7,50	5,02	3,92
Early Beauty x *Nimbus*	8,33	5,32	4,27
Early Beauty x *Argentario*	**11,36**	5,78	**5,29**
Early Beauty x *Macis*	10,56	5,85	4,86

During the growing season (July 31st 2010) we recorded the health state of the foliage of the non-grafted and grafted combinations.
Of the graft combinations tested the ones preserving their foliage best were *Lonci* x *Titán*, *Lonci* x *Argentario*, *Early Beauty* x *Titán* and *Early Beauty* x *Nimbus*.

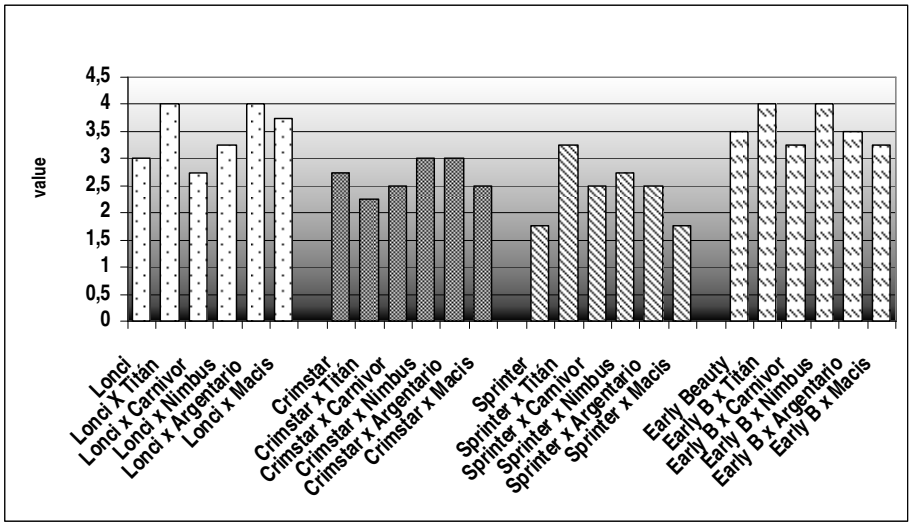

Figure 2: State of health of the foliage of grafted watermelons (2010)

The variety *Lonci*, in the grafted form, preserved the foliage in a better state of health than when growing on its own roots, except for the rootstock *Carnivor*. The foliage of *Crimstar* showed almost the same value when grafted and when growing on its own roots. In the case of the variety *Sprinter* every grafting combination had healthier foliage than the non-grafted ones from this variety. The variety *Early Beauty* showed no significant differences between the different rootstocks (*Figure 2*).

CONCLUSIONS

The study of the growth vigour of grafted plants revealed that the variety *Argentario* belonging to the *Lagenaria* type was the best in most of the cases. In accordance with the descriptions in the literature grafting is characterized by higher yields in case of almost each combination than the non-grafted variants, except for the variety *Sprinter*. Higher yields are an opportunity for a greater income for growers, though the distribution of the yield over the picking season should be taken into consideration.
As a result of the rainy and cool weather it was seen that non-grafted plants showed a greater loss of foliage than the grafted ones. Descriptions in the literature also mention the fact that grafted plants can be characterized by a higher level of resistance, which was confirmed also by our trial. Based on the aspects studied the following rootstock varieties are recommended for the container varieties tested:
1, ***Lonci***: Grafting is recommended on the rootstocks *Argentario* and *Macis*. Based on sensory qualification, again the rootstock *Argentario* is to be highlighted. It is to note that good results can be achieved also on the rootstock Titan recommended by the company selling the seeds.
2, ***Crimstar***: The rootstock *Argentario* belonging to the *Lagenaria* type achieved the best results. If it was nonetheless grafted onto an interspecific rootstock, the variety *Nimbus* would be recommended.

3, ***Sprinter***: Again, the bottle gourd rootstock is recommended, and more specifically the variety *Argentario*. Of the interspecific rootstocks the varieties *Carnivor* and *Nimbus* seem to be suitable.
4, ***Early Beauty***: It is recommended to be grafted onto the rootstock *Argentario* in order to achieve higher yields.
In the trial the container varieties were found to be preferably grafted onto rootstocks belonging to the *Lagenaria* type. The variety *Argentario*, tested also in the trial, is recommended.

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