

RESEARCHES ON THE PESTS EVOLUTION IN GRAFTED WATERMELON CROPS

CERCETĂRI PRIVIND EVOLUȚIA DĂUNĂTORILOR ÎN CULTURILE DE PEPENI VERZI ALTOIȚI

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Abstract. *Grafting, at watermelons, could be used to increase resistance to environmental stress, in order to increase resistance to soil pathogens and pests (nematodes, European mole cricket, wire, white or grey worms), also could reduce, during the vegetation period, the pests attack (aphids, thrips, two-spotted spider mite, seedcorn maggot and mining fly). It is presented the situation of the trade, made by Kileler Plants SRL with grafted seedlings of green melons, grafted vegetables from Greece. Plants obtained from grafted melon seedling have not been attacked by nematodes, and the percentage of plants attacked by European mole cricket, wireworms, white worms and gray worms was lower, less than 0.1% of grafted plants have been destroyed by pests, in respect with 4.8% from non-grafted plants. The pest control technology during the vegetation period, is presented, showing that in the case of grafted plants at least one control treatment may be reduced.*

Key words: watermelons, grafted seedlings, pests

Rezumat. *Altoirea (grafting-ul), la pepenii verzi, poate fi folosit pentru a crește rezistența la factorii de stres de mediu, pentru a obține rezistență la agenții patogeni și dăunători din sol (nematozii, coropișnița, viermii sârmă, viermii albi și buha cenușie), poate reduce, în perioada de vegetație atacul dăunătorilor (afidele, tripsii, păianjenul roșu comun, musca plântuțelor și musca minieră). Este prezentată situația comerțului, realizat de firma Kileler Plants SRL cu răsaduri altoite de pepeni verzi, legume grețate din Grecia. Plantele obținute din răsadurile de pepeni altoiți nu au fost atacate de nematozi iar procentul de plante atacate de coropișnița, viermi sârmă, viermi albi și viermi cenușii a fost mai scăzut, sub 0,1% din plantele altoite au fost distruse de dăunători, față de 4,8% în cazul plantelor nealtoite. Este prezentată tehnologia de control a dăunătorilor în perioada de vegetație arătându-se că în cazul plantelor altoite se poate reduce cel puțin un tratament de combatere.*

Cuvinte cheie: pepeni verzi, răsaduri altoite, dăunători

INTRODUCTION

Melons, considered fruits or vegetables (of some), belong to the *Cucurbitaceae* family, along with the cucumber. In general, they are known as the watermelon (*Citrullus vulgaris*-in Romanian „harbuz, lubeniță or curcubete”) or the cantaloupe with several groups or varieties, [*Cucumis melo cantalupensis*,

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Cucumis melo reticulatus and *Benincasa hispida* (melon or Chinese melon)]. Growth in protected or sheltered areas, their culture is affected by diseases and pests. The cultivated and wild watermelon appear to have diverged independently from a common ancestor, possibly *C. ecirrhosus* from Namibia (Dane and Liu, 2007). After Paris H. S., from Research teams-Newe Yaar, quoted by Strauss, (2015) the true ancestor of the modern watermelon is indigenous to northeastern Africa: *Citrullus lanatus* var. *colocynthoides*, known as gurma in Sudan and gurma in Egypt. The first crops and melon consumption were recorded 4,000 years ago, the plant being originally from Iran, India and Africa (Paris, 2015). The first record of interspecific, herbaceous grafting as a yield increase and pest/disease control strategy was for watermelon (*Citrullus lanatus*), using a squash rootstock (*Cucurbita moschata*), reportedly developed by a watermelon farmer in Japan (Tateishi, 1927). Use of grafted seedlings in commercial vegetable production occurred as early as the 1930s in Japan for watermelon grafted on *Lagenaria siceraria* (Oda, 2002). Research on grafting cucumber (*Cucumis sativus*) also started in the late 1920s, but wider commercial applications did not happen until 1960 (Sakata *et al.*, 2008). Main benefits from using grafted watermelon plants are that, in this way, is easier to manage soil-borne diseases such as *Fusarium* wilt (sometimes soil pests) and plant productivity is increasing vigorous root system at grafted plants. Grafting of seedlings has been used for decades in many parts of the world, but adoption of the technique is still limited in many countries, due in part to higher costs of grafted seedlings and the uncertainty of grafting benefits under certain conditions. In Romania, watermelon production has been continued declining since 2013, even in this year, mainly due to late spring frosts, in these conditions, watermelon imports come from Greece (about 40%), the Netherlands, Germany and Turkey in 2016, 280 times as much as exports, according to Eurostat data. It is presented the situation of the trade, made by Kileler Plants SRL with grafted seedlings of green melons, grafted vegetables from Greece. Plants obtained from grafted melon seedling have not been attacked by nematodes, and the percentage of plants attacked by European mole cricket, wireworms, white worms and gray worms was lower, less than 0.1% of grafted plants have been destroyed by pests, in respect with 4.8% from non-grafted plants. The pest control technology during the vegetation period, is presented, showing that in the case of grafted plants at least one control treatment may be reduced.

MATERIAL AND METHOD

It is presented the situation of the trade, made by firm Kileler Plants SRL with grafted seedlings of green melons (fig. 1), grafted vegetables from Greece and results obtained in condition of production, at Dăbuleni. In 2016-2017, from firm Kileler Plants SRL, considering that 2,500 grafted seedlings/ha have been planted (lower than for plants without being grafted where seedling recommended density is 4000-6000 plants/ha), result that the company provided the planting material for 502 ha (from which 456 ha in 2017) (tab. 1). The planting of the grafted seedlings was done

between April 10 and April 30, in the targeted fields, crops being protected in the tunnels (for the first period).

Table 1

The grafted seedlings sold by the firm Kileler Plants SRL in zona Dăbuleni

Companies that marketed	2016	2017	TOTAL
Velbil Trans Srl	50,000	200,000	250,000
Adrilex	15,000	700,000	715,000
Cooperativa Agricola "Gheorghe	30,000	180,000	210,000
Stoica Constantin	20,000	60,000	80,000
TOTAL	115,000	1,140,000	1,255,000

Monthly observations were made, from the planting of seedlings till the harvest time, to 7 farms (**A**-Bileru Nicolae 25 ha, **B**-Ștefănel Robert 10 ha, **C**-Popescu Marinel 3 ha, **D**-Fluerătoru Florin 5 ha, **E**-Țurlacu Daniel 3 ha, **F**-Nucu Andrian 2 ha, Rabbit Cristian 2 ha). The attack of *Fusarium* in the fields (with grafted compared to without grafted plants) has been recorded. The attack of the main diseases and pests was assessed as a scale of 1-5 notes awarded after the percentage of attacked plants (1= 0<1; 2= 1<5; 3=5<10; 4=10<25; 5=25<50). At the end of the vegetation period (at harvest) we weighed, in 4 repetitions, the fruits of 5 plants, referring the total production to the hectare.

RESULTS AND DISCUSSIONS

In Dăbuleni, the area with the largest melon plantations, in Romania, farmers generally only use grafted seedlings, most of them bought, very few and for small areas, produce grafted seedlings, even if the price of a grafted plant of watermelon or yellow is of 2-3 lei. As a curiosity in area of Dăbuleni *Lagenaria siceraria* (synonym *L. vulgaris*), also known by many other names (that include: tigva, in Romania, calabash, bottle gourd, long melon and so on), has become the preferred type of watermelon rootstock, mainly due to its resistance and affinity to the graft is the most used as parent stock. In the rest of watermelon cultivating areas from Romania, interspecific cucumber (*C. maxima* x *C. moschata*) is used for high plant vigor, higher resistance to disease, and higher tolerance to abiotic stress factors (cold, heat and salinity). The farmers ordered at firm when and which kind of grafted seedling watermelon (parent stock and graft) they want. As graft it was used varieties Celine F₁ (from France), Sorento F₁, Pata Negra F₁ (black), Baronesa F₁ (black) (from Holand), hybrids that are especially grown in the Dăbuleni area. Many of the important diseases of green melon such as fusariose, viral and bacterial diseases, and pests such as nematodes usually, are impossible to control, therefore it is necessary to strictly quit to the crop and return to the same soil only after 5-6 years. Since planting, plants from healthy grafted seedlings are healthy, uniform and during vegetation period all plants are of the same size and will develop uniformly. Important diseases managed by grafting are caused by fungal several soil-borne pathogens such as *Fusarium oxysporum* (fig. 2), *Verticillium dahliae*, *Erwinia tracheiphila*, *Phytophthora*

spp. and *Phytophthora* spp., root knot nematodes and several soil-borne pests as Root gall (fig. 3) and Sting nematodes, European mole cricket, wire worms, white grubs, grey grubs and seedcorn maggot. Farmer has less work because he spends no longer time with seedlings as the cultivator and in the same time there is an economy of land by using almost half of the number of plants used in a non-grafted crop. Plants obtained from watermelon grafted seedlings were not attacked by nematodes, and the percentage of plants attacked by European mole cricket, wire worms, white grubs and grey worms was lower, less than 0.1% of the grafted plants were destroyed by pests, 4.8% for non-grafted seedling plants. The pest control technology is modified during the vegetation period, in the case of grafted plants at least one control treatment can be minimized. In the same time in fields with grafted seedlings were applied at less 1-2 chemical treatment no longer needed (particular in May) due to the high tolerances at soil born pathogens (tab. 2) and pests (tab. 3) of grafted plants. There is no great differences on main pests and diseases (as downy mildew, fig. 4) attack which appear late spring and summer beginning. For the others most important pest (*Aphids*, *Thrips*, Seedcorn maggot, Two spotted spider mite) and diseases (*Pseudoperonospora cubensis*, *Sphaerotheca fuliginea*, *Colletotrichum lagenarium*, viral infections) which appears during vegetation period and which are not being connected with soil, benefic effect of grafting seems to be due to the rootstock which is acting as a superior conductor of water, providing more water and nutrients to the stems, leaves and fruits, mainly because of the better developed root system.



Fig. 1 Grafted watermelon seedlings



Fig. 2 *Fusarium* wilt symptoms



Fig. 3 Symptoms of root gall nematodes



Fig. 4 Symptoms of downy mildew

Influence of grafted seedlings sold by the firm Kileler Plants SRL in area Dăbuleni on the frequency of pathogens

Farm	Hybrid seedlings								Grafted seedlings									
	<i>Fusarium oxysporum</i>	<i>Verticillium dahliae</i>	<i>Erwinia tracheiphila</i>	<i>Phyium spp. and Phytophthora spp</i>	<i>Didymella bryoniae</i>	<i>Pseudoperonospora cubensis</i>	<i>Sphaerotheca fuliginea</i>	<i>Colletotrichum lagenarium</i>	<i>Viral infections</i>	<i>Fusarium oxysporum</i>	<i>Verticillium dahliae</i>	<i>Erwinia tracheiphila</i>	<i>Phyium spp. and Phytophthora spp</i>	<i>Didymella bryoniae</i>	<i>Pseudoperonospora cubensis</i>	<i>Sphaerotheca fuliginea</i>	<i>Colletotrichum lagenarium</i>	<i>Viral infections</i>
A	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	
B	1	1	1	2	1	2	2	0	1	0	1	1	1	1	2	2	0	1
C	1	2	1	2	1	3	2	1	1	1	0	1	1	1	2	2	1	1
D	2	2	1	2	1	2	3	1	1	1	0	1	1	1	1	1	1	1
E	3	1	1	3	1	3	3	1	1	1	1	1	1	3	3	1	1	
F	3	2	2	3	1	3	3	1	2	1	1	1	1	3	2	2	1	

There is an increased yield in fields where were cultivated grafted seedling plants than in those fields where are cultivated non-grafted seedlings (tab. 4) this fact is due to the rootstock acting as a superior conductor of water, providing more water and nutrients to the stems, leaves and fruits, mainly because of the better developed root system. Due to an earlier and better start harvesting is, of course and harvesting is done earlier and the price is higher.

Table 3

Influence of grafted seedlings sold by the firm Kileler Plants SRL in area Dăbuleni on the frequency of pests

Fa	Hybrid seedlings									Grafted seedlings								
	Root gall and Sting nematodes	European mole cricket	Wire worms	White grubs	Grey grubs	Aphids	Thrips	Seedcorn maggot	Two spotted spider mite	Root gall and Sting nematodes	European mole cricket	Wire worms	White grubs	Grey grubs	Aphids	Thrips	Seedcorn maggot	Two spotted spider mite
A	1	1	0	1	0	2	3	0	3	0	0	0	0	0	2	2	0	2
B	1	1	0	2	1	3	3	0	3	0	1	0	1	0	2	2	0	3
C	1	0	0	2	1	3	2	1	2	0	0	0	0	0	2	1	0	2
D	2	1	1	2	0	4	3	1	3	0	0	0	1	3	3	0	2	
E	1	1	0	3	1	2	3	1	4	0	1	1	0	0	3	2	1	3
F	2	0	0	3	0	4	3	1	3	0	1	1	2	1	3	3	1	3

Influence of grafted seedlings sold by the firm Kileler Plants SRL in area Dăbuleni on the production (t/ha)

Farm	Hybrid seedlings	Grafted seedlings
A	95	120
B	95	115
C	85	100
D	95	105
E	90	100
F	80	95

CONCLUSIONS

Grafting is an important integrated pest management strategy to manage soil borne pathogens and other pests of watermelon crops.

Grafting of watermelon onto resistant rootstock was found to provide effective resistance to *Fusarium* wilt but at an increased cost per hectare and with an increased yield in fields where were cultivated grafted seedling plants than in those fields where are cultivated non-grafted seedlings

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