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The Peculiarities of Vegetable Grafting Technology in Georgia

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ABSTRACT. Since vegetable grafting technology is relatively new to Georgia, it is very important to further develop the introduced technology, and testing of adapted species to be grown in different regions of Georgia under various climate and soil conditions. Within the study, the ability of the plants to match with other species were identified for Georgia, as well as potential productivity of their combination varieties. It was established that Tomato rootstock TD2 F1 affects the grafted one and in the result, the plant starts blooming period earlier and the amount of yield is increased. Maxifort F1 causes difference in the growth of a plant; a grafted plant grows a bit better and faster in compare with un-grafted one. In case of sweet pepper, the diseases have not been identified either, though, the rootstock positively influenced on the quantity of the crop. As it is evident from the results of pumpkin cultures study, it is desirable to test the grafted plants in an environment where a source from which disease can be spread is present because the above- mentioned technology is one of the measures applied in order to fight against these diseases. *© 2018 Bull. Georg. Natl. Acad. Sci.*

Key words: vegetable grafting, rootstocks, grafting-stocks, combination varieties, disease resistance

It is very important to further develop the technology of vegetable grafting and conduct testing of the introduced and adapted species to be grown in different regions of Georgia under various climate and soil conditions.

The aim of the research is to supply Georgian farmers to produce highly competitive vegetable and orchard cultures with the help of the grafted seedlings studied within the present project. The object of research: 15 combinations of 6 cultures were presented for study, namely, 7 tomatoes, 4 aubergines, 1 sweet pepper, 1 cucumber, 1 water melon, and 1 melon.

Material and Methods. The study was conducted on 3-3 cultures of solanaceae and cucumber families, particularly on tomato (*Licopersicum esculentum Mill*), sweet pepper (*Capsicum annuum*), aubergine (*Solanum melongena*), cucumber (Cucumis sativus L.), melon, (*Cucumis melo*), and water melon. (*Citrullus lanatus*).

For tomato, aubergine and sweet pepper rootstocks of the same vegetables were used. But for “pumpkin family” sprout rootstock was used.

Table 1. The number of plants survived

Grafted combinations	Number of grafted plants (unit)	Saved plants	
		number	%
Tomato	350	215	61
Aubergine	254	149	58
Sweet pepper	45	12	27
Cucumber	108	25	23
Water melon	88	8	9
Melon	88	7	8

To produce scion-grafted seedlings, the Hole Insertion Method (HIG) was used .

From rootstocks and grafting-stocks a hybrid grafted seedling was obtained, also within family of the culture – a mixed grafted combinations of cultures were tested. Accordingly, within one culture we got 9 combinations, and in 6 cultures we got – 54. Some mixed combinations of cultures were added (e.g. tomato (rootstock) x aubergine (rootstock), tomato x sweet pepper : 18 variations altogether. We received 72 grafted combinations: 12 rootstocks and 18 for grafting which were moved to the testing Plot of Agricultural Research Center of Georgia. There some advantages of grafted vegetables and orchard cultures were demonstrated. The chosen testing plot also had a demonstration function where the representatives of research institutions and farmers associations were invited to observe testing process to see the results of the study and participate in the grafting process.

Next to the grafted plants, control rootstocks were planted which were later used to conduct phenological and morphological studies and comparison.

For rootstocks the following vegetables were used: Tomato - Maxifort F1 and TD-2F1; Aubergine - ZippyF1, NiloF1 and RedScorpion F1; Sweet pepper - TE135F1; Pumpkin - 109W F1 . Also the rootstocks of cucumber, water melon and melon.

For grafting we tomato used: Belfort F1,Shady lady F1, also B-3 and B-13 (rosy tomato and local species of tomatoes.) Aubergine – Nilo F1; Sweet pepper - Samanter F1; Cucumber - Olimpian F1;

Water melon - Dinasty F1; Melon - Merlin F1.

Sowing: plants from solanace family were sown 10.03.2016 Grafting process took place:

Tomato – May 3-5. 2016; Aubergine – May 6-7. 2016; Pumpkin family crops - May 17-20.2016 . Planting: tomato, aubergine, sweet pepper – June 14. 2016. Cucumber, melon, water melon - June 31. 2016

The study of basic phenological characteristics was conducted based on BBCH scale. The method of grafting the vegetables is based on the principle of joining rootstocks and cambium grafting plant roots. This principle is carried out through different methods in different cultures.

After grafting, the seedlings are used to be transplanted to a particular environment with adequate technology; specifically they were planted in an adaptation space where they were kept for 6-7 days on following conditions: 25^0 temperature and 95% humidity.

Grafting took place before the seedlings of the above mentioned cultures were grown in a greenhouse. The sowing process took place in the containers specially allotted for the seedlings. After grafting process was finished, grafted seedlings were moved to an adaptation camera for 6-7 days, and after they were returned back to greenhouse until the seedlings were ready to be replanted in the field.

The following aspects of the grafting process were studied percentage of seedlings left after

Table 2. Influence of rootstock on phenological characteristics

Tomato	Height of plant (cm).	Harvest (kg)	Harvest per one plant
Maxifort F1× BelfortF1	1.25	27.10	1.35
TD2 F1 × Belfort F1	1.10	19.95	1.66
Belfort F1	1.0	22.85	1.14
Maxifort F1×Shady lady F1	0.85	23.10	1.15
Shady lady F1	0.8	9.70	0.48
TD2 F1 × Shady lady F1	0.7	19.7	1.23
Maxifort F1×B3-8	1.35	18.60	1.16
B3-8	1.30	20.40	1.27
Maxifort F1×B3-13	1.45	21	1.3
TD2 F1 × B3-13	1.40	42.35	3
B3-13	1.40	19.10	1.19
Maxifort F1	1.75	_	_
TD2 F1	1.50	-	-

grafting of each c ulture. After transplanting – the beginning of blossom; full blossom, the first typical fruit, type of plant growth, height of the plant. Observation was carried out on Verticillous wild, on Fusarium wilt and resistance against other pests and diseases.

Results

Table (1) shows that, the highest percentage of survival has tomato (61%) and the lowest indicators have water melon and melon (8-9%). The influence of rootstocks on phenomenological development and on other characteristics was studied.

It is noteworthy that rootstocks -Maxifort F_1 and TD -$2F_1$ had no influence on tomato hybrid Belfort's grafted plants (Maxifort F_1 x belfort F_1; TD -$2F_1$ x Belfort F1) beginning of blossom, full blossom and beginning of ripening (The rootstocks were compared with non grafted hybrids for control). Different results were depicted in grafted plants of Shady lady and B3-13 combinations, in particular: combinations of grafted plants TD2 F1 x Shady lady F1 and TD2 F1 x B3-13 started blossom earlier than control plants (non-grafted) and grafted combinations with Maxifort.

There has been a difference identified between average amounts of crops which was obtained from grafted combinations; The difference was namely in the following combinations: TD2 F1 x Belfort F1, TD2 F1 x Shady lady F1, TD2 F1 x B3 -13, the crop was more than the crop collected from control combinations: Maxifort F1. Rootstocks also has an effect on the height of the plants: height of grafted plant - Maxifort F1 exceeded the control ones. It should be noted that Maxifort F1 is characterized by strong undetermined growth (1.75 cm), while TD2 F1 – semi-determined growth (1.50 cm). In this case, a rootstock had very little influence on the strength of plant growth.

The same observation process was carried out on aubergine. In this case, 4 types of rootstocks were selected and one root for grafting. From those rootstocks - 3 were aubergines and 1 tomato - Maxifort F1. The beginning and full flowering period in all four combinations were the same. Also, the first typical fruit appeared in aubergine x aubergine combination, but in tomato x aubergine combination the fruit did not develop. So, there was no crop.

In case of sweet pepper, one grafted combination (TE135F1 x Samanter F1) was compared to un-grafted seedling, also, a rootstock was planted separately. It should be mentioned that grafted and un-grafted versions do not differ significantly according to their phenological development and heigh; though, on one plant, on average was picked up a higher yield (0.44 kg-control, and 0.29 kg – grafted one). The amount of crop gathered was different in case of cucumber, e.g. in a grafted plant 109W F1 x Olimpian F1, the yield picked up was by 70 % higher than in control one.

Conclusion. Tomato rootstock TD_2 F1 affects the grafted one and as the result, the plant starts blooming period earlier and the amount of yield is increased. Maxifort F1 causes difference in the growth of a plant; a grafted plant grows a bit better and faster in compare with un-grafted one. In case of sweet pepper, the diseases have not been identified, though, the rootstock positively influenced on the quantity of the crop. As it is evident from the results of pumpkin cultures study, it is desirable to test the grafted plants in an environment where a source from which disease can be spread is present because the above-mentioned technology is one of the measures applied in order to fight against the diseases: Verticillium wilt, Fusarium wilt.

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სოფლის მეურნეობის მეცნიერება

ბოსტნეულის მყნობის ტექნოლოგიის თავისებურებები საქართველოში

ნ. კაკაბაძე

საქართველოს სოფლის მეურნეობის მეცნიერებათა აკადემია, თბილისი, საქართველო

(წარმოდგენილია აკადემიის წევრის ა. კორახაშვილის მიერ)

ბოსტნეული კულტურების მყნობის ტექნოლოგია საქართველოსთვის სიახლეს წარმოადგენს, შესაბამისად მნიშვნელოვანია ჩითილის წარმოების ტექნოლოგიების სრულყოფა, რასაც წინ უძღოდა საქართველოს განსხვავებულ ნიადაგურ-კლიმატურ რეგიონებში გავრცელებული ბოსტნეული და ბაღჩეული კულტურების გასავრცელებლად დაშვებული, ადაპტირებული და ინტროდუცირებული ჯიშების გამოცდა და საცდელი ნაკვეთების მოწყობა, მყნობის ტექნოლოგიის დახვეწასთან ერთად ჩვენ მიერ შერჩეულ იქნა ცალკეული ბოსტნეული და ბაღჩეული კულტურების ახალი საძირეები და სანამყენეები, დადგენილ იქნა სხვადასხვა ჯიშებთან/ჰიბრიდებთან მათი შეთვისების უნარი, კომბინაციების მრავალფეროვნების პოტენციური პროდუქტიულობა.

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