

SOUTHERN HORTICULTURE

UDC 634/.7.037

HORTICULTURE NURSERY OF THE CRIMEA – INTENSIVE BASES

**Valentina Viktorovna Tankevich, Aleksandr Ivanovich Sotnik,
Anatoly Ivanovich Popov, Timur Serverovich Chakalov**

Nikita Botanical Gardens – National Scientific Centre, branch “Crimean experimental station of orcharding”

297517, Republic of the Crimea, Simferopol region, Malenkoye vil.
sadovodstvo@ukr.net

Introduction

All over the world they pay great attention to development of agriculture including horticulture. The main task is to provide population by fruits, berries and by-products of their processing, that take quite important role in a human life.

The initial descriptions of gardens can be found in manuscripts that belong to 3000 BC (Assyria, Babel, India, China). Crimean horticulture, which appeared in IX-X centuries being a scion-rooted Tatarian gardens were in consumer's demand. On peninsula with its moderately tropical climate and about 2,5 thousand of plant species, to grow majority of fruit-bearing and some subtropical culture is possible, as this area is situated between latitudes 46⁰21' and 44⁰23' North and longitude 32⁰30' and 36⁰30' East according to Greenwich. In the beginning of XIX century in the Crimea, close to Yalta, Nikita Botanical garden was founded, and in 1913 – Crimean experimental station of gardening, what became a start of South horticulture. Successful development of this branch was fixed in 50-70s last century. Later due to a number of objective and subjective causes decreasing of gross harvest of fruits, crop capacity took place, and as a result - reduction of agricultural lands.

In the end of XX century total orchard area made 60 thousand ha. Nowadays in structure of agricultural lands perennial plantations occupy 72,5 thousand ha, including 39 thousand of fruit-bearing plants. Allowing for their present condition there is a necessity to replace unproductive plants and plant new modern plantations tending to 50 thousand ha by 2024. Realization of this tasks requires annual growing of 1,5 mln of fruit-bearing seedlings, free of principal virus. Production of so much planting stock needs new certified mother plants of tree stocks and grafts. Today this area makes 63 ha including 28 ha with free of virus plants. In the Crimea there are 11 nurseries with permits, most of which cultivates ordinary production. “Crimean fruit company” CO Ltd. of Krasnogvardeisky district and “Fruit Nursery” of Nizhnegorsky district are engaged in growing the virus-free and sanative seedlings. Other nurseries are small-scale and mostly provides population demands. About a half of million of fruit seedlings were cultivated in 2014, including 40% of virus-free plants.

Intensive base in the Crimean horticulture nursery is necessary to realize mentioned plans, that is to introduce modern adopted to local agroecological conditions species, seedling stocks, advanced technologies for seedling growing, cultivation of virus-free planting stock.

Research objective is to create and match promising seedling stock, cultivar and seedling stock combinations, free of virus, practice and improve elements of standard planting stock cultivation.

Objects and methods of the research

Investigations were carried out within experimental areas of the Crimean experimental station of horticulture in Piedmont zone of the Crimea. Soils are southern carbonate chernozem with medium concentration of nitrogen slip forms (relatively 1,5-1,9 and 2,8-6,5 per 100 g of dry soil) and high content of exchange potassium (44-58 mg).

Study objects: seedling stock, cultivar and seedling-stock combinations, technologies applying in mother plants, nursery and garden. The way of work corresponds to methodics of field investigations with fruit-bearing cultures [2, 4, 6].

Results and discussions

Foundation of the Crimean experimental station of horticulture in 1913 on peninsula, according to references and archival data, caused development of agrotechnical component in horticulture of the region. The project that included urgent then and considerable now tasks was developed. Selection of local seedling stocks and development of cultivation technologies of planting stock were of great importance like species selection.

Grigorovich N.A. underlines in his article, published in 1917, necessity to research natural, historical and economical conditions of the station area, including reasons of chlorosis, tree infecundity and effect of seedling stocks and combinations of species and seedling stocks on growth and plant fruiting in gardens.

In the nursery Crimean OSS (today branch Horticulture “Krymstantsiya” SBE “NBG-NSC”) most points of planting stock cultivation were investigated. Various banding materials (paper, fibre, film) were tried. Banding by chlorvinyl film prevent moisture loss and oxidation of tanning agents, what is important for nurseries in south with arid hot climate. In recent decades films destroying by light are in great use, this material considerably saves outlays on its removal.

Due to researches that had taken place since 60s it's possible to accelerate seedlings cultivation using winter inoculation, otherwise it makes possible to get standard seedlings on slow-growing seedling stocks, omitting the first field and cutting them on a low stem [6]. But in the Crimea it needs 2 years. During one vegetation period it's possible to cultivate seedlings, that meet OST standard, out of winter inoculations in non-heated film rooms [5]. According to study research having optimal plantation scheme 40x10 sm it's possible to get 2000 of standard seedlings.

Tatarinov A.N., Merehko I.M., Kolesnik V.M. [1, 3, 7] were involved in development of technological methods [1, 3, 7]. Tankevich V.V., Sotnik A.I., Popov A.I. and Lyapugin I.V. followed this work. As a results of long-term researches there is a list of cultivars biologically capable to branching of seedlings: apple tree (*Malus domestica* Borkh.) – “Avrora”, “Dhonagold”, “Salgirskeye”. “Predgornoye”, Tavriya”; pear tree (*Pyrus communis* L.) – “Dream”, “Maria”, “Tavricheskaya”. These cultivars mainly belong to station selection, according to many parameters they exceed foreign analogs.

The best height of inoculation was determined as 28-40 sm. Optimal period for seedlings top removal was found out as well. By our data, top removal should be planned since the second decade of June every two weeks. Yield of standard seedlings makes 85% in this way.

Kolesnik V.M. developed resource-saving technology of fruit seedlings cultivation in film containers. Yield of standard seedlings reaches 400 thousand per hectare. This technology makes it possible to use worthless for agriculture areas, what is of great importance for mountainous and piedmont cultivation districts.

In different period station scientists as follows were engaged in selecting the most productive seedling stocks of apple, pear and other fruit cultures: Tatarinov A.N., Merezhko

I.M., Borisenko I.G. Nowadays these points are a field of activity for Tankevich V.V., Sotnik A.I., Lyapugin I.V., Popov A.I., Chakalov T.S. Researches of many years proved prospectivity among seeds as a seedling stock for apple trees – “Sara Sinap”. According to opinion of Doctor of Agricultural Science (PhD), Tatarinkov A.N., till 60s of XX century all nurseries in the Crimea, Moldova, Bukovina, Uzbekistan, Kazakhstan started working with seedlings of the very cultivar.

Later, as far as clonal seedling stocks were transported into the Crimea (under control of Berezovsky G.A. and Tatarinov A.N.), horticulture took M.2, M.3, M.4, M.9, M.M. 102 and MM. 106. Agronomists-operatives Popov I.T., Tankevich B.N. and Tikhohod K.T. made huge contribution into development of horticulture nursery at the station and in the Crimea.

At present in collection stool of the gardening branch “Krymsadstantsiya” a large fund (more than 60 forms) of seedling stocks with vegetative propagation for apple and pear trees. This fund includes seedling stocks of either foreign or domestic (own selection as well) breeding (fig.1). The most productive, early-maturing, adapted to soil and climatic Crimean conditions plants are in process of selection now.



Fig.1 Collection stool of clonal seedling stock of apple and pear trees

According to results of long-term work seedling stock for apple trees K 104 (breeding of horticulture nursery laboratory) was put into Register Book of Ukraine plant cultivars, in 2015 all necessary documents for its putting in zoning in Russia were prepared. By growth intensity it occurred between M. 9 and MM. 106 (fig.2). Trees grafted on K. 104, gained good anchor base, high crop capacity and great fruit tastes. Average yielding for 14 years, allowing for different damages of fruit buds by frost, makes 14-16 t/ha (table 1). Cultivation efficiency of “Golden Delicious”, Dzhonagold” and “Krymsky” on seedling stock K. 104 is 113-123%.

Table 1

Crop capacity of cultivar and seedling stock combinations within 14-years old garden

Layout	Seedling stock	Average crop capacity for 2000-2014, t/ha				
		Golden Delicious	Dzhonagold	Kimmeriya	Krymskoye	Reinette Simirenko
4 x 2 m	M.9	16,5	13,2	17,6	16,8	14,3

	K 104	15,9	14,3	16,1	15,1	13,9
	Д 1071	13,6	11,4	14,8	13,7	12,8
	62-396	26,2	19,8	21,2	22,7	21,5
4 x 3 m	MM.106	13,9	15,4	13,9	14,5	13,1
	M.26	12,3	12,8	14,7	16,4	10,7
	D1161	15,7	17,8	16,9	12,1	-
HCP ₀₅ :						
By cultivars – 6,4						
By seedling stock – 5,8						

As a result of long-term scientific activity station nurserymen bred poorly growing seedling stock for pear trees KA 53, KA 61, KA 86, Ka 92, tolerant to a high concentration of CaCO₃ in soil (up to 40%). Productivity of these seedling stocks in the stool is 20-30% as much than BA 29 has (table 2).

Table 2

Efficiency of clonal seedling stocks in stool for pear tree, 2003-2014

Seedling stock	Offset yielding per 1 ha, thousand of units			
	Totally		Including standard	
	Average for 2003-2014	2014	Thousand, units	%
BA-29 (κ)	324,8	332,6	272,7	82
KA 53	341,0	339,1	239,3	80
KA 86	363,2	370,3	296,2	80
KA 92	351,0	380,0	365,5	85
IS 2-10	332,0	332,7	276,1	83
HCP ₀₅	16,8	30,6	29,9	

Yielding of standard seedlings within nursery is no less than 85%. Study of seedling stocks makes it possible to reveal prospectivity of cultivar and seedling stock combinations: “Izyuminka Kryma”, “Dream”, “Tavricheskaya”, on Ka 53, Ka 92 (fig.3). Efficiency degree is 20-25% as much than on BA 29 and makes 140%.

In recent years prospective seedling stocks for peach (*Persica vulgaris* Mill.) are thoroughly investigated. Among seed plants GF-305 was emphasized, among clonal – Kuban 86. Crop capacity of peach “Veteran” on Kuban 86 made 29-32 t/ha (table 3).



Fig. 2 Eight-years old apple tree “Dzhonagold” on seedling stock K 104



Fig. 3 Seven-years pear-tree “Maria” on seedling stock Ka 92

Table 3

Garden yield of peach cultivar and seedling stock combinations

Seedling stock	Veteran		Collins		Sochny	
	yielding, ton/ha					
	2009	Average for 2003-2009	2009	Average for 2003-2009	2009	Average for 2003-2009
Almonde (κ)	27,0	23,3	24,5	22,2	22,6	24,0
Brompton	26,0	20,8	23,8	19,8	20,4	21,7
Kuban 2	27,0	25,1	24,1	24,3	23,4	24,1
Kuban 86	32,0	29,0	26,3	25,8	24,6	27,2

BBA-1, Evrika 99 and seedling stocks for cherry (*Cerasus avium* (L.) Moench) in plantations with small crowns are studying as well.

Highly developed world gardening is based on virus-free horticulture nursery. France, the USA, Italy, Belgium, Holland and Germany use the state systems to produce healthy planting material and control its quality level. Ordinary, non-tested, material is cultivated restrictedly, and considerable difference at price stimulates virus-free production.

In recent decades mass distribution of virosis, bacterial infections and quarantine pests within our region became a result of a lack of control system after quality and phytosanitary condition of plantation, spontaneous way of seedling production and realization. Branch intensification suppose obligatory transfer of the Crimean horticulture to virus-free base,

what makes it possible to reduce pesticide load on environment within sanitary resort zone and increase garden efficiency to a large degree.

Table 4

Impact of virus injuriousness on apple yielding

Variants	Yielding, ton/ha			
	Golden Delicious		Aurora Krymskaya	
	1990	Average per 7 years	1990	Average per 7 years
1. ChBL + pit of apple timber	21,2	104,5	16,3	80,7
2. Striation of apple timber	16,7	100,6	18,1	89,1
3. ChBL + pit + striation of apple timber	20,9	107,3	19,2	83,3
4. ChBL + pit+ being gutta-percha	19,7	89,0	15,0	69,8
5. Control	30,6	132,8	24,4	96,1
HCP ₀₅		9,1		5,1

Protective package against virus includes early and strict diagnostics, which makes it possible to find out plant state, reveal and put away damaged material in time, select good parent plants and propagate them. In the Crimea this process isn't developed due to lack of virus-free planting material. Cultivars and stocks of seed cultures are mainly infected by latent viruses. The following damages of plants are especially spread: timber pit, striation and chlorosis blotch of leaves. Virus ChBL is the most spread. According to scientists from department horticulture nursery KOSS Tatarinov A.N., Tankevich V.V., Popov A.I. yielding reduction of Reinette, Simirenko and Aurora makes 25-39%, 30-40 ton/ha, what brings down service life of gardens to a large degree.

In recent years Krymsadstantsiya has carried out serious measures testing cultivars and stocks (including its own selection) to find out the principal harmful viruses and define main points of their further propagation. Parent and seedling gardens, stool areas of clonal stocks for apple and pear are projected.

Conclusions

Setting up of modern and progressive fruit plantations is based on new promising stocks and cultivar-stock combinations - adapted to locality agroecological conditions - combined with highly productive cultivars and rational methods of cultivation using virus-free potential.

References

1. *Kolesnik V.M.* Vыход sazhentsev iz shkolki pri raznykh temperaturah stratifikatsii // Sadovodstvo, vinogradarstvo i vinodeliye Moldavii. – 1963. - № 9. – S. 42-44.
2. *Kondratenko P.V., Bublik O.M.* Metodika provedeniya polyovykh doslidzhen z plodovymy kulturamy. – K.: Agrarna nauka, 1996. – 96 s.
3. *Merezhko I.M.* Kachestvo posadochnogo materiala i produktivnost plodovykh nasazhdeny. – K.: Urozhay. – 1991. – 149 s.
4. Programma i metodika sortoizucheniya plodovykh, yagodnykh i orekhoplodnykh kultur / Pod red. G.A. Lobanova – Michurinsk: VNII sadovodstva. – 1973. – 492 s.
5. *Tankevich V.V., Tatarinov A.N.* Vyrashchivaniye sazhentsev sposobom zimnih privivok v otkrytom i zakrytom grunte. Sadovodstvo, vinogradarstvo i vinodeliye Moldavii.- 1991. - № 11. – S. 48-54.

6. *Tatarinov A.N., Berezovsky G.A., Shcherbatko D.M.* Zimnyaya privivka yabloni na karlikovyh podvoyah // 50 let Krymskoy opytnoy stantsii sadovodstva. – Rosselkhozizdat USSR. – 1963. – T.6 – S. 62-171/

7. *Tatarinov A.N., Zuyev V.F.* Pitomnik plodovykh i yagodnykh kultur. – M.: Rosselkhozizdat. – 1984. – 269 s.

The article was received at editors 25.06.2015.

Tankevich V.V., Sotnik A.I., Popov A.I., Chakalov T.S. Horticulture nursery of the Crimea – Intensive bases // Bull. of the State Nikit. Botan. Gard. – 2015. – № 116. – P. 29-35.

The article presents summary and results of long-term investigations in the field of stocks, cultivar-stock combinations and methods for cultivation of competitive pruned plant material of fruit-bearing cultures. This research covers work of scientists of the Crimean experimental horticulture station for last 50 years. It brings up necessity to transform Crimean horticulture to virus-free work way and the main aspects of the Crimean horticulture nursery as well.

Key words: *horticulture nursery; stock; provine; maternal plant; the Crimea.*

UDC 634.11:632.421.12

ASSESSMENT OF ECONOMICAL AND BIOLOGICAL CHARACTERISTICS OF WINTER APPLE CULTIVARS

Nadezhda Alekseyevna Litchenko, Nadezhda Nikonorovna Gorb

Nikita Botanical Gardens – National Scientific Centre,
branch “Crimean experimental station of horticulture”
297517, Republic Crimea, Simferopol district, Malenkoye vil.
sadovodstvo@ukr.net

Introduction

Crimean peninsula has got quite favorable soil and climatic conditions for horticulture development. Fruits, cultivated in the region, are characterized by high taste and dietic properties. They are in great demand and could be an important item for export and economy stabilization of the Republic. Reduction of sanitary standard for fruit consumption has a negative effect on human body and causes oncolytic diseases. That's why foundation of new intensive perennial fruit plantations takes a big role in development of the Crimean agriculture. Planting of new gardens in the region is realized allowing for scientifically grounded zonality of fruit cultures, as natural and climatic conditions has a big range.

Apple is the key fruit culture being in a structure of the Crimean plantations. Soon its part in the gardens will make 65-70%. The Peninsula attracts tourists all year round, and during this period guests and inhabitants of the region must be supplied by fresh fruit production completely. Apple trees, in particular winter cultivars which provide consumers in winter-spring, are of great importance to solve this task. Hereafter this cultivar group will make 80-85% from the total value cultivated in the Crimea. It should be noted these climatic conditions are favorable for growing winter apple cultivars.

Objects and methods of the research

Branch “Crimean experimental station of horticulture” was involved in studying the economical and biological peculiarities of apple cultivars with winter ripening, its own breeding: Aurora Krymskaya, Kimmeriya, Krymskoye, Krymskoye Zimneye, Predgornoye,