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PRODUCTIVITY OF THE MOTHER ROOT AND CUTTING GARDEN OF THE PUMISELECT CLONE ROOTSTOCK IN THE STEPPE OF UKRAINE

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The dynamics of productivity of the mother root & cutting garden of the Pumiselect clone rootstock was studied, taking into account the soil and climatic conditions of the steppe zone of Ukraine, as well as technological aspects of crop management. In the first three years of vegetation of mother plants, there was an intensive build-up of the aboveground part of the bushes, which gave rise to transfer them to the state of operational plantings. Taking into account the annual complete alienation of growth in the next 4-9 years, significant aging of plants occurred, which was manifested in a decrease in habitus indicators, the number of shoots and their length. As a result, the productivity of mother root plantings decreased (the number of cuttings from 570.2 thousand units)/ha up to 133.6 thousand units/ha), which limited the feasibility of long-term cultivation in order to obtain lignified cuttings.

***Keywords**: Pumiselect, clone rootstock, mother root plantings, shoots, biometric characteristics, lignified cuttings.*

Problem statement. The natural conditions of Ukraine are favorable for growing a wide variety of fruit and berry crops. In recent years, the domestic fruit and berry industry has been developing rapidly, and fruit production has stabilized at almost 2 million tons. Despite a significant reduction in the area of plantings at fruit-bearing age, gross yield was largely compensated by an increase in the level of average yield [1, 2]. A noticeable growth potential for the collection of vitamin products was observed in the farms of the steppe zone, as the most suitable for growing heat – loving stone-fruit crops, where their production increased 1.34 times over the past 15 years, and the yield – 1.97 times [3].

The use of clone rootstocks is one of the reserves for the intensification of fruit growing. Rationally selected rootstocks depend not only on the strength of growth and the period of entry of the garden into fruiting, but also on the yield, winter hardiness, drought resistance and durability of plantings. They make it possible to change the production technology, reduce the variation in the growth and fruiting of grafted trees in homogeneous plantings, accelerate the beginning of fruiting, and improve the quality of fruits [4]. Taking into account the peculiarities of the technological process and market relations, the best rootstock-graft combinations can make fruit production profitable.

Dwarf rootstock Pumiselect isolated in Germany (Geisenheim Research Institute) [5], proposed for apricot, cherry plum, peach and plum. It forms a powerful root system. It is drought-resistant, cold-resistant, resistant to Plum shark virus. Trees on the rootstock of Pumiselect grow small-the growth Force is half that on seedlings of cherry plums, wild apricot and almonds. They are characterized by high bud awakening and fruitfulness, low shoot-forming ability, high quantitative and qualitative indicators of the crop during the early entry of plantings into fruiting. Plants are demanding of the soil, do not withstand flooding well. It is recommended for intensive plantings of stone-fruit crops.

In this regard, studies on promising methods of rootstock reproduction are relevant, taking into account the biological characteristics of plants and a complex of abiotic factors.

Due to analysis of recent research and publications. Pumiselect rootstock is considered as promising for laying intensive orchards of stone fruit crops in various soil and climatic conditions, in particular, in the USA [6], Poland [7-9], the Czech Republic [10], Serbia [11], Tajikistan [12] and Ukraine [13, 14]. The expediency of using Pumiselect rootstock for Peach [4, 6, 8], apricot [9, 11], plum [10] is shown.

The classic technology of reproduction of plants of the Pumiselect clone rootstock involves the use of a culture of vertical and horizontal layering. At the same time, in practice, propagation by lignified cuttings is also quite common. In [12], it was shown that when propagated by lignified cuttings, the highest percentage of rooting of Pumiselect rootstock cuttings was 86% in the variant treated with Kornevin at a concentration of 0.1%. Based on research [13], it was revealed that the Pumiselect clone rootstock was characterized by a high degree of rooting for a long time, which gave reason to consider its reproduction by lignified cuttings in the conditions of southern Ukraine as quite technological and promising. The rooting rate of cuttings was 68.3-82.0%, the yield of standard planting material was 67.9-81.3%.

In [14], it was found that the quality of rootstock plants obtained using the technology of reproduction by lignified cuttings is significantly higher compared to growing by Vertical cuttings. The yield of standard rootstock plants when rooting cuttings was 91.78%, while when propagating by vertical jigging it was only 60.19%. Final calculations showed that the profit from production when growing rootstocks with lignified cuttings was 2.16 times higher compared to propagation by vertical cuttings, and the level of profitability was 114.14 and 94.95%, respectively.

Analysis of scientific data obtained both in foreign countries and in Ukraine indicated the prospects of using Pumiselect rootstock and conducting research on its intensive reproduction. The issues of productivity of the mother root & cuttings garden and the duration of operation of Pumiselect rootstock plantings for harvesting lignified cuttings, depending on the biometric indicators of mother root plants in the steppe of Ukraine, were not comprehensively considered.

The purpose of the research is to study the elements of productivity of the mother root & cutting garden of the Pumiselect clone rootstock and justify the period of its effective operation in the steppe of Ukraine.

Materials and methods of research. The research was carried out on the basis of the nursery of LLC "Pidguryevskoe" of the Pervomaisky District of the Mykolaiv region, a branch of the Department of viticulture and fruit and vegetable growing of the Mykolaiv National Agrarian University. The experimental farm was located in the northern steppe zone, the northern steppe subzone was insufficiently moistened with ordinary chernozems. The terrain of the territory was slightly sloping, the slope of the south-eastern exposure was up to 1°.

The material for conducting the research was the Clone rootstock of Pumiselect. The Experiment was laid in 2007 yr with improved planting material. The area where the queen cells were located was separated from the field crop rotation. Its predecessor was black fallow. The soil of the experimental site was ordinary chernozem, formed under mixed grass-feather grass-tipchak vegetation on loess rocks. The humus content in the arable layer was 3.3–3.8%, the humus layer was powerful and reached 150 cm. At a depth of 50-60 cm, the humus content decreased to 2.8-3.0%. The content of mobile phosphorus (by Machigin) was 21 mg/kg (average), the content of exchange potassium was 303 mg/kg of soil (increased). The average hydrolyzed nitrogen content was 90 mg/kg of soil (high). The calcium and magnesium content was very high as 24.2 mg/100 g of soil and 3.9 mg/100 g of soil, respectively. The amount of absorbed base alkali was 28.8 mg/100 g of soil (increased). Moreover, in the sum of the absorbed bases, the main share was occupied by calcium (84.0%), the smallest one was sodium (2.4%). The content of total carbonates in the surface layer didn't not exceed 1.1%, the content of "active lime" didn't not exceed 0.5%, which ws safe for fruit crops. The reaction of the soil solution was slightly alkaline (pH=7.1). According to the mechanical composition, the soil of the experimental field was light clay, the content of physical clay ranged from 55–60%. According to the complex of general characteristics and indicators, the soil met all the conditions for maintaining perennial fruit plantations with additional application of mineral fertilizers.

The scheme of placement of mother plants in a mother root-cuttings garden of 3.0 x 1.0 m. preparation of the site, planting, care of plantings, harvesting of rootstocks and cuttings was carried out in accordance with generally accepted technologies and recommendations for the care of mother root plantings.

The structure of queen cells according to biometric indicators (height, diameter of plants, number of shoots and their length) was determined at the end of the growing season by measuring 100 plants (25 plants in four-fold repetition). The number of shoots of zero branching order per plant was taken as the main indicator of variation. Subsequently, the entire array of observations and records was ranked at intervals of 30 shoots. Harvesting of shoots for cuttings was carried out on mother root plantings (mother root & cutting garden) in the autumn (and decade of November) and spring (and decade of March) terms.

Mathematical processing of the results was performed in Microsoft Office Excel 2007.

Presentation of the main material. During the first year of growing season of mother root plantings, a complex of agrotechnical measures was aimed primarily at the survival rate of planted plants. In general, weather conditions contributed to a balanced passage of growth processes, including the growth of the root system and the aboveground part. At the end of the growing season, the average height of plants was 0.85 m. A small number of shoots that grew at sharp angles, and their length, contributed to the formation of a compact habit. The area of the crown projection in relation to the area of nutrition that was allocated to mother plants was developed slowly and amounted to only 0.3%.

During the first three years of cultivation, young mother plants were fully formed and met the parameters that make it possible to transfer them to the category of operational plantings. During this period (1-3 years), the height of plants gradually decreased from 1.89 m to 1.80 m, while the crown diameter did not change and amounted to 1.69-1.70 m, relatively stable biometric indicators of the crown did not lead to a change in its habit. Calculations showed that the crown index was 1.09 up to 1.12, the crown projection area was 2.11 up to 2.24 m2, and the ratio of the crown projection area to the feeding area was 0.71 up to 0.76. The working row spacing remained wide enough, which did not interfere with mechanized tillage, protecting plantings from pests and diseases.

At the end of the 4th year of vegetation (2010), the appearance of mother plants was rounded, the crown habit index was 1.12 (Table 1). In plants of the 4th year of cultivation, many shoots had large angles of departure, and the height of the plants exceeded their diameter. Taking into account the fact that the plant placement scheme was somewhat sparse (3.0 x 1.0 m), this did not lead to the fact that the projection area of the plant crown exceeded the allotted feeding area. A similar relationship between the studied indicators was observed at the end of the growing season in plantings of the 5th and 6th years of cultivation. In the future, some features in the condition of mother root plantings were revealed, taking into account their age and operating technology.

Table 1

Biometric characteristics of mother root & cutting plantings of the Pumiselect clone rootstock

Age of plantings	Plant height (H), m	Plant diameter (D), м	I=H/D	S projections, m²	S projections / S nutrition
4	1.89	1.69	1.12	2.24	0.75
5	1.86	1.70	1.09	2.27	0.76
6	1.80	1.64	1.10	2.11	0.71
7	1.65	1.55	1.06	1.89	0.63
8	1.11	1.20	1.05	1.13	0.38
9	0.89	0.84	1.06	0.55	0.18
Average	1.53	1.44	1.06	1.70	0.57
LSD_{05}	0.09	0.09	-	-	-

The annual mass harvesting of cuttings depleted the mother root plants. Building up new shoots during the year, and then removing them in the autumn period, it did not leave the possibility of accumulating plastic substances to undergo balanced growth processes in the spring of the following year. This was manifested in changes in the main indicators of habit, primarily the height and diameter of mother root plants in the next three years of their operation. Moreover, every year there was a clear tendency to reduce the biometric indicators of mother root plants.

So, already in the plantings of the 7th year of cultivation, the average height of plants was only 1.65 m, in the 8th year it was 1.11 m, in the 9th year it was 0.89 m. that is, during the next 3–year cycle of operation of plantings, there was a clear decrease in the average height of plants, which was 89.2%, 60.0% and 48.1%, respectively, compared to the average indicators of 2010-2012 yrs.

From the 4th to the 9th growing season, the crown diameter also gradually decreased-from 1.69 m to

0.84 m and the crown projection area decreased from 2.24 m^2 to 0.55 m^2. In the end, this led to the fact that the ratio of crown indicators projection area/ feeding area significantly decreased from 0.75 to 0.18. It should be noted that the shoots developed equally evenly in the radial direction. This contributed to the fact that the working row spacing of plantings even increased from 1.32 m to 1.80 m.

As records showed in the initial period of operation of mother root plants, the crown diameter significantly exceeded the distance between them in a row. In a row, the shoots of one plant were placed in the adjacent area of the projection of the crown of the neighboring plant by an average of 22 cm. As the plantings aged, as already noted, the crown diameter decreased and, as a result, the penetration of shoots of one plant into the crown of a neighboring plant decreased, too. So, in the first years of operation of plantings (4–6 years of cultivation), the penetration of shoots into the neighboring zone of plants at the end of the growing season was 32-35 cm. As the plantings aged, the penetration of shoots significantly decreased and by the 8th year the cultivation of plantings was only 10 cm.

The lowest biometric indicators were characterized by mother root plants at the end of the growing season of the 9th year of cultivation. The crown index was 1.06. Moreover, the crown diameter was significantly smaller than the distance between neighboring plants and decreased to 0.84 m. The projection area was equal to 18.0% of the feeding area that was allocated for mother root plants when laying plantings. Reducing the habit of the crown, primarily its diameter, led to an increase in technological passage in row spacing, but it did not affect the use of equipment in any way.

The overall aging of plants and the decrease in basic biometric indicators significantly affected the productivity of mother root plantings. Thus, during the 5th-9th years of cultivation, there was not only a change in the habit of mother root plants, but also its structural components, first of all, the number and length of shoots. There was an obvious tendency to reduce these indicators during the entire cycle of operation of mother root plantings (Table 2).

Table 2

Dynamics of shoot-forming ability of Mother root plantings of the Pumiselect clone rootstock

Age of plantings	Shoot		Increment		
	length, cm	number, PCs.	plant, m	ha, 1000 m	%
5	79.9	53.5	42.7	142.3	158.6
6	74.7	47.7	35.6	117.7	131.2
7	72.8	40.8	29.7	99.0	110.4
8	63.0	26.6	16.8	56.0	62.4
9	53.0	18.9	10.0	33.3	37.1
Average	71.1	37.9	26.9	89.7	100.0
LSD_{05}	4.86	2.61	-	-	-

In the 5th-7th years of operation, the largest number of shoots and their growth were observed both per plant and per unit area. With increasing age of plantings, the number of shoots per plant and their length decreased, and these indicators were lowest in plants of the 9th year of cultivation. The average growth of shoots of one mother root plant decreased from 42.7 m to 10.0 m, or 4.3 times, and the total growth decreased from 142.3 thousand m/ha to 33.3 thousand m/ha. In the 8th-9th year of operation of mother root plants, their significant depression was detected. The average growth length decreased by 26.8-50.8%, the number of shoots decreased by 20.1-28.3%. This could not but negatively manifest itself in the overall growth of plantings. If in the initial period (6-7 years) the decrease in the length of shoot growth, which fell on one plant, was insignificant (7.0%), then in subsequent years the tendency to reduce the length of growth increased.

It is known that the placement of leaves on the shoot, their self-shading negatively affects the process of photosynthesis. One of the indicators that determine the feasibility of the plant placement scheme and their feeding area is the area of the assimilation surface, which falls on the feeding area or the projection area of mother root plants. The dynamics of reducing the diameter of mother root plants was slower than the dynamics of the area of the leaf apparatus, which led to a significant decrease in the assimilation surface per unit projection of the plant (Table 3).

In young plants (5th year of cultivation), the area of the Leaf apparatus was slightly larger than the area of nutrition, their ratio was 1.57. As the plantings aged, this indicator changed significantly, it was the lowest in the 9th year of cultivation and it was only 0.21. that is, if 1.0 m2 of the area of nutrition of a 5-year-old plant accounted for 1.57 m2 of leaf surface, then in the 9th year-0.21 m2, or 5.73 times less. Intensive operation of the mother root & cutting garden for 4–5 years, in which a significant share of the growth was alienated annually, caused its intensive aging, which was manifested in a decrease in the biomorphological indicators of plantings.

Table 3

Dynamics of the leaf area of mother root plantings of the Pumiselect clone rootstock

Age of plantings	Leaf area, m^2			Ratio	
	plant	Ha	%	Sl/ Sn	Sl/ Sp
5	4.72	15733.2	186.9	1.57	2.08
6	3.25	10833.2	128.7	1.08	1.54
7	2.59	8633.2	102.5	0.86	1.37
8	1.43	4766.6	56.6	0.48	1.26
9	0.64	2133.3	25.3	0.21	1.16
Average	2.53	8419.8	100.0	0.84	1.64
LSD_{05}	0.18	-	-	-	-

Note. Sl – Leaf area, m^2; Sn – plant nutrition area, m^2; Sp – area of plant projections, m^2.

In the mother root & cutting garden of the Pumiselect clone rootstock, where the main indicator of the feasibility of using plantings was the growth of the current year, the number of shoots could be the basis for gradation of plants into groups. Surveys showed that more than 100 shoots could form on well-developed plants during the year. Plants that had limited development contributed to the regrowth of only 10–20 shoots. In our work, the variation on this feature was in the range of 10 up to 100 shoots.

At the beginning of the operation of mother root plantings (the 5th year of cultivation), the plants were of somewhat different quality, but at the same time they were almost evenly represented in the established groups (Table 4). Thus, the number of plants of Group I, where 0–30 shoots were formed, was 30.5%, Group II (31–60 shoots) was 27.0%, and Group III (61–90) shoots was 26.3%. The lowest number was found for plants of Group IV (90–120 shoots) as 16.2%.

Table 4

Structure of the mother root & cutting garden of the Pumiselect clone rootstock, %

Age of plantings	Plant groups by number of shoots				Number of plants per 1,0 ha, PCs
	I 0-30	II 31-60	III 61-90	IV 91-120	
5	30.5	27.0	26.3	16.2	100.0
6	35.2	31.5	22.3	11.0	100.0
7	43.7	33.0	16.8	6.5	100.0
8	68.0	25.2	6.8	0.0	100.0
9	87.0	13.0	0.0	0.0	100.0
Average	52.9	25.9	14.5	6.7	100.0

With an increase in the age of plantings, there was a decrease in their productivity not only in general, but also the very structure of individual groups in the mother root-cuttings garden changed. It was found that the number of plants on which the maximum number of shoots (Group IV) grew out of 540 PCs / ha up to 216.7 PCs/ ha significantly decreased. In the 8th-9th year of cultivation, plants of Group IV were completely absent. The same trend was observed for plants of Group III. The number of such plants in the plantings of the 5th year of cultivation was 26.3%, the 7th year of cultivation it was 16.8%. There were absolutely no such plants in the most summer plantings of the 9th year of cultivation.

It is obvious that a decrease in the number of the most productive mother root plants in plantings with age leads to an increase in the proportion of plants with lower productivity indicators in plantings (Table 5). So, if in the plantings of the 5th year of cultivation the share of the least productive plants (Group I) was 30.5%, then in a year it was 43.7%, in three years it was 43.7%, in five years it was 87.0%. A slight increase in the proportion of plants belonging to Group II in plantings of the 6th-7th years of cultivation can be explained by the fact that over time the proportion of plants of groups III-IV decreased, and the proportion of unproductive plants increased significantly.

Table 5

Structure of the mother root & cutting garden of the Pumiselect clone rootstock, PCs/ ha

Age of plantings	Plant groups by number of shoots				Number of plants per 1,0 ha, PCs
	I 0-30	II 31-60	III 61-90	IV 91-120	
5	1016.7	900.0	876.6	540.0	3333.3
6	1173.3	1050.0	743.0	366.0	3333.3
7	1456.6	1100.0	560.0	216.7	3333.3
8	2266.6	840.0	226.7	0.0	3333.3
9	2900.0	433.3	0.0	0.0	3333.3
Average	1762.6	864.7	481.3	224.7	3333.3
LSD_{05}	128.1	60.9	33.5	15.2	-

Along with the number of shoots that grow on mother root plants, a qualitative indicator is important as the length of shoots. Less developed plants were characterized by the fact that the average length of shoots was shorter than that of the most developed plants. Moreover, this trend continued with age, although the absolute values changed slightly. Thus, the average growth for plants for the entire period of research ranged from 61.6–82.0 cm (Table 6).

Table 6

The length of shoots depending on the condition of the mother root plants of the Pumiselect clone rootstock, cm

Age of plantings	Plant groups by number of shoots				%
	I 0-30	II 31-60	III 61-90	IV 91-120	
5	69.0	75.3	81.5	84.6	112.4
6	64.5	70.1	77.3	81.1	105.1
7	62.3	67.6	72.3	80.3	97.9
8	60.2	63.1	68.1	0.0	88.6
9	51.9	55.5	20.0	0.0	74.5
Average	61.6	66.3	74.8	82.0	100.0
LSD_{05}	4.38	4.51	5.42	5.69	-

The greatest length of shoots was observed in mother root plantings in the first years of their operation. As the plantings aged, the growth length decreased, and a decrease in the average shoot length was noted regardless of the degree of development of the mother root plants. Thus, in plants of Group IV, this indicator decreased by 5.4% over three years. For plants of Group III, the average shoot length decreased by 12.0% over four years, for plants of Group II and Group I over five years the length decreased by 13.4%.

It should be noted that as the plantings aged, the growth rate decreased, which was determined separately for each group of plants (Table 7.). So, if in the least developed plants in the initial period of operation of plantings it was 10.4 m, then over the years it decreased to 7.8 m. The same trend was observed for mother root plants, in which the number of shoots was 31–60 as the total increase decreased from 33.9 m to 24.9 m. The decrease in the length of growth over five years of operation of mother root plants in relation to the average productivity ranged from 159.8% to 37.4%.

Table 7

Growth length depending on the condition of the mother root plants of the Pumiselect clone rootstock, m / plant

Age of plantings	Plant groups by number of shoots				%
	I 0-30	II 31-60	III 61-90	IV 91-120	
5	10.35	33.88	61.12	88.83	159.8
6	9.68	31.54	57.98	85.16	133.1
7	9.34	30.42	54.22	84.32	107.2
8	9.03	28.40	51.08	00.00	62.6
9	7.78	24.98	00.00	00.00	37.4
Average	9.24	29.84	44.88	51.66	100.0
LSD_{05}	0.67	2.17	3.26	3.81	-

As the mother root plantings aged, as already noted, the number of shoots on one plant decreased. These circumstances led to the fact that in the 8th year of vegetation, no mother root plants of Group IV were found, which had the maximum growth length, and in the 9th year as Group III. A significant share in the plantings was represented by plants of Group II, in which an average increase of 29.8 m was noted

Taking into account the structure of the mother root & cutting garden and age-related changes in plantings, the dynamics of its productivity was established. As could be seen from the above calculations, the qualitative composition of plantings decreased with aging, which led to a decrease in the total length of growth. So, if in the first years it was 133.1 up to 159.8% of the average productivity, then in the 8th-9th years of operation it was much less as 37.4–62.7%. Basically, the decrease in the productivity of plantings was noted due to the fact that subsequently the most productive plants belonging to groups III-IV were absent. Although, it should be noted that more developed plants that moved from a larger group to a smaller one slightly increased their indicators (Table 8). The total growth of plants of Group I, taking into account their number, increased from 10.5 thousand m / ha (5th year of cultivation) to 22.6 thousand m / ha (9th year of cultivation). But a significant increase in the structure of plantings of plants of the first group did not allow to compensate for the losses of the most productive plants.

Table 8

Total growth depending on the condition of mother root plants of the Pumiselect clone rootstock, thousand m/ha

Age of plantings	Plant groups by number of shoots				%
	I 0-30	II 31-60	III 61-90	IV 91-120	
5	10.522	30.492	53.578	47.968	159.8
6	11.358	33.117	43.079	31.168	133.1
7	13.605	33.462	30.363	18.272	107.3
8	20.467	23.856	11.580	0.000	62.7
9	22.562	10.824	0.000	0.000	37.4
Average	15.703	26.350	27.720	19.482	100.0
LSD_{05}	1.02	1.85	1.98	1.44	-

If we consider the productivity of mother root plantings of the Pumiselect clone rootstock in order to obtain lignified cuttings, then the negative dynamics with increasing age of plantings is obvious. As the plants aged, their productivity significantly decreased. In particular, for the 5th-6th year of cultivation, the total increase allowed to harvest 474.9 up to 570.2 thousand units / ha of cuttings, and for 7-8 years it was 223.6 up to 382.8 thousand units / ha (Table 9).

Table 9

Productivity structure of mother root plants of the Pumiselect clone rootstock, thousand m / ha

Age of plantings	Total length of shoots		Number of cuttings by size 0,25 m	
	Per mother root plant, m	per 1,0 ha mother root & cutting-cuttings garden, thousand m	Thousand PCs/ha	%
5	42.77	142.56	570.2	100.0
6	35.62	118.72	474.9	83.3
7	28.71	95.70	382.8	67.1
8	16.77	55.90	223.6	39.2
9	10.02	33.39	133.6	23.4
Average	26.77	89.19	356.8	62.5
In total	133.89	446.27	1785.1	-

The lowest productivity of mother root plantings was characterized by the 9th year of cultivation as 133.6 thousand units / ha of cuttings, that is, there was a decrease in the productivity of mother root plantings during the five years of their operation by 4.3 times. It should be noted that the total length of shoots that grew per 1.0 hectares of the mother root & cutting garden from the 5th to the 9th years of vegetation was

446.3 thousand m, which made it possible to prepare 1.78 million cuttings with a size of 0.25 m.

As a result of the research, a general trend towards a decrease in the productivity of the mother root & cutting garden in the dynamics from the 5th to the 9th year of vegetation of mother root plants of the Pumiselect clone rootstock was noted. The length of shoots, the length of growth, and the qualitative composition of plants decreased, which further affected the rooting of cuttings and the quality of the resulting rootstocks. It is obvious that cyclic operation of such plantings is needed, which will help extend the duration of their productive use.

Conclusions. Based on the conducted scientific studies on the productivity of the mother root & cutting garden of the Pumiselect clone rootstock in the conditions of the steppe of Ukraine, the following conclusions were formulated:

1. During the first three years of cultivation, young mother root plants formed morphostructural elements that gave rise to transfer them to the state of operational plantings. The dynamics of the formation of the height and diameter of mother root plants during this period made it possible to sufficiently justify the optimal plant placement schemes and feeding area.

2. Taking into account the almost complete alienation of annual growth after the end of the growing season, with an increase in the age of mother root plants, a decrease in their habit was revealed, which led to a decrease in the productivity of plantings. The height of mother root plants for five years of intensive operation decreased by 2.1 times, the width decreased by 2.0 times, the crown projection area decreased by 4.1 times, the leaf apparatus area decreased by 7.4 times.

3. A direct relationship was found between an increase in the age of mother root plants and changes in habit indicators and the main morphological elements which determined their productivity. There was an annual decrease in the number of growing shoots and their length, which, in turn, led to a decrease in the total length of growth from 142.3 thousand m/ha to 33.3 thousand m/ha, or 4.3 times.

4. In the most productive period of operation of mother root plantings, it was possible to prepare 35.6 up to 42.8 m of growth per plant and 474.9 up to 570.2 thousand units/ha of cuttings, while from aging plantings it was only 10.0 up to 16.8 m of growth per plant and 133.6 up to 223.6 thousand units / ha of cuttings.

Thus, the mother root plants of the Pumiselect clone rootstock, when used intensively, significantly reduced their biometric indicators with increasing age of plantings. Moreover, already in the 7th-9th years of cultivation, there was a sharp decrease in the productivity of plantings and the quality of cuttings, which led to a reduction in the duration of active plant life.

Prospects for further research are to develop elements of cyclic operation of the mother root & cutting garden, which will help to extend the duration of productive use of mother root plants for harvesting lignified cuttings.

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В. В. Заморский, Т. Н. Камедько, Т. Н. Манушкина, Н. А. Самойленко, В. Д. Бушилов.
Продуктивность маточно-черенкового сада клонового подвоя пумиселект в условиях Степи Украины

Исследована динамика продуктивности маточно-черенкового сада клоновых подвоев пумиселект с учетом почвенных и климатических условий зоны Степи Украины, а также технологических аспектов ведения культуры. В первые три года вегетации маточных растений происходило интенсивное наращивание надземной части кустов, что дало основание перевести их в состояние эксплуатационных насаждений. С учетом ежегодного полного отчуждения прироста в последующие 4-9 лет происходило значительное старение растений, что проявлялось в уменьшении показателей габитуса, количества побегов и их длины. В конечном итоге снижалась продуктивность маточных насаждений (количество черенков от 570,2 тыс. шт./га до 133,6 тыс. шт./га), что ограничивало целесообразность длительного ведения культуры с целью получения одревесневших черенков.

Ключевые слова: *пумиселект, клоновый подвой, маточные насаждения, побеги, биометрическая характеристика, одревесневшие черенки.*

В. В. Заморський, Т. Н. Камедько, Т. Н. Манушкіна, Н. А. Самойленко, В. Д. Бушілов.
Продуктивність матково-живцевого саду клонового підщепи пуміселект в умовах Степу України

Досліджено динаміку продуктивності матково-живцевого саду клонових підщеп пуміселект з урахуванням грунтових і кліматичних умов зони Степу України, а також технологічних аспектів ведення культури. У перші три роки вегетації маточних рослин відбувалося інтенсивне нарощування надземної частини кущів, що дало підставу перевести їх в стан експлуатаційних насаджень. З урахуванням щорічного повного відчуження приросту в наступні 4-9 років відбувалося значне старіння рослин, що проявлялося у зменшенні показників габітусу, кількості пагонів і їх довжини. В кінцевому підсумку знижувалася продуктивність маточних насаджень (кількість живців від 570,2 тис. шт./га до 133,6 тис. шт./га), що обмежувало доцільність тривалого ведення культури з метою отримання здерев'янілих живців.

Ключові слова: *пуміселект, клонова підщепа, маточні насадження, пагони, біометрична характеристика, здерев'янілі живці.*