AGROTECHNOLOGICAL PRINCIPLES OF PRODUCTION OF PLANTING MATERIAL *SALIX MATSUDANA L.* AND THE FEATURES OF ITS USE IN THE IMPROVEMENT OF RECREATIONAL FACILITIES

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The environmental strategy of cities and other settlements is aimed at developing and preserving the city's plant fund, for this purpose a system of monitoring the condition of green spaces is used. It requires a set of measures that ensure appropriate control, development of measures for the restoration and protection of territories, forecasting the condition of perennial plantings, taking into account environmental conditions and other factors that determine their condition and level of improvement [8, 10, 12, 14, 16]. At the same time, the main components of the monitoring system for the condition of perennial plantings are: - assessment of quantitative and qualitative indicators of the condition of plants in the territory; - identification and establishment of the main causes of the deterioration of the condition of plantings; - development of a comprehensive program of measures aimed at eliminating the consequences of the impact of negative factors on perennial plantings and eliminating the factors themselves; - modeling the development of the situation.

Relevance. Today, there is a need to create perennial plantings near lakes and reservoirs, which are located both in the surrounding areas and within the boundaries of the settlement. In connection with the above, there is a need to search for fast-growing taxa and their decorative forms that have high decorative characteristics. From this list, the most promising are *Salix* species and hybrids, which can be widely introduced into the improvement of urban areas [16]. Therefore, an important element in landscaping settlements where there are or are planned to create reservoirs is the use of *Salix* cultivars, and in particular *Salix matsudana* L. These taxa must meet two main requirements: growth rate and decorativeness. Therefore, the issue of using *Salix* in landscape design is relevant.

Purpose and objectives of the research. Scientific and practical justification of the possibility of producing planting material *S. matsudana* for the improvement of recreational facilities.

To achieve the set goal, the following tasks were performed:

- to analyze the taxonomic composition of representatives of the genus *Salix* L.;
- to study the influence of the thickness of the cutting material on the biometric indicators of *S. matsudana* plants;
- to consider the influence of growing conditions on the growth and development of *S. matsudana* plants;
- to provide suggestions for the use of *S. matsudana* for the creation of recreational facilities.

The object of the research is *S. matsudana*.

The subject of the research is the botanical and biological properties of *S. matsudana*.

The genus *Salix* is the most numerous among the family *Salicaceae.* Its representa-

tives are found in various climatic zones - from deserts to tundra. Approximately 30 taxa of the mentioned genus grow in Ukraine, a number of cultivars are used in landscaping. *Salix* in the alpine, subalpine belt of mountains, forest-tundra and tundra, play a corresponding role, sometimes the main role in the creation of plant stands [4, 21]. In the forest zone, they are temporary, inhabiting burned and cut-down areas, later replaced by long-lived species. In the deserts and steppe zone, they grow in lowlands and floodplains of rivers.

Figure 1. Salix caprea L.

S. caprea (Fig. 1) is a tall shrub or tree up to 20 m in height. The bark is smooth, gray-green. The wood under the bark has a reddish tint. Mature shoots are bare, thick. The buds are brown in color, large. The leaf blade is ovate or elliptical, 12-17 cm long, the edges are serrated, the veins are clearly defined, the underside is pubescent, there are stipules that fall off early [20].

The catkins are thick, large; the female catkins are green, oblong, and the male catkins are yellow. Flowering occurs before the leaves bloom, in March - April.

The fruits ripen during May - June and are collected in axils. The species belongs to fast-growing, frost-resistant and shade-tolerant species. It is a fairly common species in Ukraine [24, 26, 30].

Today, various decorative forms of *S. caprea* are used in landscape design: Kilmarnock (Fig. 2), Bredina (Fig. 3), Pendula (Fig. 4) and others.

Figure. 2. S. caprea Kilmarnock

Kilmarnock (Fig. 2) is a deciduous, ornamental tree grafted onto a stock with an umbrella-shaped or weeping crown, shoots hanging down. The height of the plant depends on the level of grafting, mainly 1.2-2 m, the width is 1.0-2 m. The tree after grafting grows to a height of no more than 20 cm. The branches of *Salix* Kilmarnock rise up to 40 cm and hang down. With regular pruning, the crown acquires a decorative appearance: lush, beautiful, umbrella-shaped. The leaf surface is wrinkled, oblong-elliptical, dull green, grayish on the underside, with stipules, autumn color is yellow. Flowering occurs in March - April, before the buds swell, the bare branches are covered with fluffy, soft, yellow-golden catkins, with a pleasant aroma. Spectacular decorative catkins delight the owner from early spring until the leaves appear. The bark on the shoots is gray-green, and gray with age. The root system is located in the upper soil layer (up to 0.45 m).

Kilmarnock is an undemanding plant, but it needs a lot of water and light for its development. It can grow on various soils, but prefers light loamy soils, from slightly alkaline to slightly acidic, on light soils it may shed its leaves, it is advisable to avoid high lime content.

Salix on a trunk is a beautiful plant for the garden. Trunk plants have been used for quite a long time. These plants mark the entrance to the porch or the house. They are used for mixed compositions and garden plots. They look attractive in alley plantings and topiary gardens.

Kilmarnock is suitable for landscaping gardens and parks in single and group plantings, near water bodies, as a single plant, or even planted in a container.

Frost resistance zone: 4. It is wind-resistant, sensitive to late frosts.

Figure 3. S. caprea Bredina

Bredina is a tree that has a highly decorative crown (Fig. 3). It forms long, thin, hanging branches. The crown thickness reaches 170 cm. The plant is demanding on moisture, feels good along roads and on forest edges. The mentioned decorative form lives up to 35 years. The leaf blade is oval, smooth, with a pointed tip. The flowers are yellow. The length of the catkins, which have decorative beauty, is 30-40 mm.

The decorative form is not picky about the soil environment, tolerates autumn frosts and low temperatures in the winter period. It is quite photophilous, but can grow in conditions of relative light deficiency.

It is used in single and mixed compositions.

Figure 4. S. caprea Pendula

Pendula is a highly ornamental tree (Fig. 4). It is widespread in Central Asia and Eastern Europe. The ornamental form is used in landscaping, it has a weeping, rounded crown and a flat central conductor.

In addition, it is characterized by rapid growth, reaching 50-100 mm, and the growth of the crown is 200 mm, and therefore constant removal of excess branches is performed to form the shape. The leaves are olive-green in summer, and in autumn they acquire a golden color. The named representative is winter- and frost-resistant, but it is desirable to insulate it. *Salix* is watered periodically, but the water should not stagnate. At the same time, in the summer period it is necessary to spray the crown. An important role is played by the application of mineral fertilizers during the growing season. Seedlings are planted in a fertile substrate of optimal acidity, which is well aerated. Pendula is combined with various types of coniferous and decorative deciduous species, where it is the main component, and has an attractive decorative appearance.

Figure 5. S. cinerea L.

S. cinerea is a plant up to 7 m tall (Fig. 5). The wood does not turn red under the bark. The stems are covered with gray hairs. The leaf blade is ovate, up to 13 cm long, wrinkled, the edges are serrate, the stipules are toothed. The flowers are dioecious. Flowering occurs before or simultaneously with the swelling and opening of the buds. The fruits ripen in the third decade of May - the first decade of June. The taxon is winter- and frost-resistant, shade-tolerant, undemanding to the soil environment. The cultivar is widespread in Kazakhstan, Southern Europe, Central Asia and Siberia.

Plants of the mentioned taxon are planted near water bodies – they grow and develop well in conditions of sufficient moisture supply. Gardeners and landscape design specialists use the named species to form hedges. The taxon fits perfectly into the composition of a park or a square. The bush will look perfect in combination with deciduous species that have a golden color. Some specialists plant *Salix* in oriental-style gardens.

The cultivar is undemanding to the soil environment, but light loamy soils are best for it. *S. cinerea* will develop well in conditions of close groundwater.

For planting planting material, it is advisable to prepare a planting pit measuring 60*60 cm. The pit is filled one third with a substrate, which includes compost, field soil and peat (1:1:1). When planting, mineral fertilizers are applied. When planting *Salix* to form a hedge or alley, a trench is dug 45 - 60 cm wide and 50 cm deep.

It is advisable to buy planting material with an undamaged root system. A seedling with a closed root system is planted at any time of the year - from March to November. Seedlings with a bare root system are planted before the buds swell.

After planting, *Salix* requires watering - from 15 to 25 liters of water once every 10 days. In hot weather, water the plant once every seven days.

Pruning of bushes is carried out once or twice during the growing season. The first pruning is advisable to carry out in spring, and the next - in July.

The plant responds well to fertilizing with complex fertilizers. Fertilizers are used two to three times, starting in spring and ending at the end of July.

Young plants require shelter for the winter season. In addition, it is best to plant *Salix* in areas that are protected from drafts and winds - otherwise the planting material will freeze in winter.

Figure 6. S. cinerea Tricolor

Tricolor is a standard tree with a dense rounded crown and raised, very thin, flexible, numerous shoots (Fig. 6). The height of the tree is 2.5-3 m, the diameter of the crown is 2.5-3 m. The leaves are bluish-green, silky with strokes and spots of cream, and in spring a pinkish-cream shade. The flowers are oblong. The catkins are colored in yellow, cream and red. It blooms in the third decade of April, simultaneously with the swelling of the buds. The decorative form is undemanding to the soil environment, grows on relatively moist and dry soils, from slightly alkaline to slightly acidic. The decorative form is photophilous, withstands conditions of relative light deficiency. In the hot period, it requires a sufficient amount of moisture, is wind-resistant, and does not tolerate transplanting well. It requires shaping pruning. It is used in solitary and group plantings, for creating compositions, and decorating reservoirs.

Figure 7. Salix alba

S. alba is a dioecious plant belonging to the *Salicaceae* family (Fig. 7). The tree is up to 27 m high and up to 2.5 m thick. The crown is round, wide. The bark is cracked, gray. Young shoots of *Salix* have fluffy-silvery tips, and branches are brown, bare. Buds are red-yellow, sharp, pressed to the stem. Leaves are up to 13 cm long, lanceolate, edges are finely serrate, apex pointed, silvery-villous, stipules fall off. Young leaves are drooping, have a white-silvery hue, adult leaves are white-silvery above. The leaf blade is pubescent along the central vein below, and glabrous above. The flowers of *S. alba* are unisexual, collected in catkins. Male flowers are cylindrical, yellow, 6-8 cm long and up to 10 mm wide, female flowers are thin, greenish. Bract scales are pale in color. Fruit is a capsule, trees bloom during April - May after the formation of leaves. The culture is long-lived (90-120 years), light-loving, frost- and winter-hardy. It is distributed in Central Europe, Central Asia, Siberia, and the Caucasus.

The mentioned species is a forest-forming species in river floodplains. It often forms pure, highly productive stands. It grows along the banks of reservoirs, in wet meadows.

The taxon is one of the early and valuable honey plants. Bees take nectar, bee glue and pollen from Salix plantations. Bees make up to 3-4 kg of honey per day (150 kg from 1 ha) from nectar. Willow honey is golden yellow in color, when crystallized it becomes fine-grained, acquires a creamy shade, and has good taste.

S. alba is a light-loving plant. The plant requires regular, abundant watering. It is undemanding to the soil environment, but grows better on well-aerated, moist and fertile soils [5]

It is used in the landscaping of parks, for creating alleys on the banks of reservoirs and forming recreational areas. At the same time, it is often planted near the house, where under its lush crown you can hide from the bright sun's rays. It has a decorative appearance in single plantings.

One of the ways of reproduction of taxa of the genus *Salix* is seed, but they also have a high ability to root propagation. At the same time, artificial generative propagation of plants of the mentioned genus is used in breeding work [1, 29].

The seed method of propagation of plant organisms of the genus *Salix* is of production value for introduced cultivars. Ornamental plant forms transmit their properties to their descendants only through root propagation. In nurseries, plant organisms of the genus *Salix* are propagated vegetatively. At the same time, due to the large number of root buds, taxa of the genus *Salix* can reproduce by various methods of asexual reproduction - lignified and green cuttings, mere cuttings, stakes, particle formation, etc.

Plants of the mentioned genus, due to their biology, are able to reproduce both by vertical and horizontal cuttings. Vertical cuttings are formed in places of siltation. In the nursery business, the cultivation of seedlings by cuttings is practically not carried out.

Figure 8. Planted cuttings of Salix

The main planting material for representatives of the genus *Salix* is cuttings (Fig.

8), rods, branches, stakes. The simplest, most convenient and economically feasible way of propagating plant organisms of the genus is lignified microshoots [1].

Experimental studies on the influence of microshoot size on their reproductive capacity and further plant growth of the main cultivars of the genus *Salix* were carried out by Ya. D. Fuchylo and M. V. Sbytna [33]. The results of their studies showed that the optimal length of cuttings for some species is 20-30 cm. These scientists also found a correlation between the size of the microshoot, the height of the annual planting material and the number of formed lateral shoots on the stem.

According to N. Yu. Vysotskaya [1], the optimal size of the cutting is 25-30 cm and a diameter of 7 - 10 mm.

Some scientists suggest using microshoots approximately 0.30 m long and 6-13 mm thick for root propagation [33].

At the same time, the vast majority of scientists who have studied the features of root propagation by cuttings of some cultivars of the genus *Salix* do not recommend harvesting cuttings from the upper part of the branch. Experiments on the influence of shoot type on root formation ability were conducted by Ya. D. Fuchylo and M. V. Sbytnaya [33], and for certain taxa of this genus they found that the number of rooted microshoots was higher when taken from the medial and basal parts of the stem. The above-mentioned researchers, in their experimental work, also analyzed the influence of exogenous hormonal compounds on the processes of callus and coregenesis in microshoots, and subsequent plant growth. They found that indolyloleic acid was the best root stimulant for some members of the *Salix* genus, when cuttings were taken from the medial part of the branch. Cuttings from the apical part of the stem have a long growth period and are not able to lignify before the onset of winter cold. In addition, they are significantly thinner than microshoots from the medial and basal parts of the stem and have a lower nutrient content, which negatively affects root formation and further plant growth.

There are two points of view regarding the period of cuttings of representatives of the genus *Salix*. Some researchers believe that to reduce the intensity of work in the spring period, it is advisable to plant microshoots in the first decade of November [28, 31]. At the same time, the vast majority of experimenters unanimously prove that cuttings can be planted both in spring and autumn, but they prefer spring planting dates, since planting material planted in the cold season takes root worse and is affected by low temperatures [33].

Vysotska N. V. [1] in her experimental work proved that the autumn and spring terms of planting cuttings are practically equivalent.

Fuchylo Ya. D. and Sbytna M. V. [33] recorded that the reproductive capacity and growth of planting material are influenced not only by the period of harvesting and planting microshoots, but also by soil fertility indicators. At the same time, on soils that contain a sufficient amount of nutrients and in humid areas, these indicators are better [23].

Regarding the problem of using plant growth regulators, in the experiments of Ya. D. Fuchyla and M. V. Sbytna [13] it was found that treatment of *Salix viminalis* cuttings with indolyloleic acid negatively affects the course of callus and coregenesis processes, as well as their further growth, since rooting in the control variant was significantly higher and the height of the plants was greater than when treated with growth regulators.

Fuchylo Ya. D. and Sbytna M. V. [13] found that *Salix caprea* belongs to easily rooted cultivars. For root-owning propagation of this taxon, it is advisable to prepare cuttings from the basal part of the stem in spring, approximately 15 cm long and 8-20 mm in diameter. It is advisable to root the named species without using hormonal compounds. However, some scientists deny that this method can be used to root individual decorative forms of the named taxon [9]. Considering the above information, in the process of plant propagation by cuttings, it is advisable to take into account not only the botanical characteristics of the taxon, but also the varietal ones. In addition, experimenters do not suggest cutting microshoots from the upper part of the stem during the propagation process. They suggest treating the prepared cuttings with a heteroauxin solution before planting, and before that, soaking them in water for 20 hours. Planting is carried out in a nutrient substrate under conditions of adequate water supply.

In general, exogenous compounds of hormonal nature do not significantly affect the processes of callus and coregenesis, since the difference between rooting in the search variant and the control was up to 1-3%. The minimum rooting value was observed in the following taxa: *S. caprea* and *S. cinerea*. It is likely that the above-mentioned cultivars need to be propagated generatively.

In the conditions of the stationary polygon of the BNAU, the influence of the type of cutting material on the survival of microshoots in different taxa and decorative forms of representatives of the genus *Salix* was analyzed. At the same time, in the process of performing the search work, it was found that the optimal size of the microshoot for most cultivars is 15 cm, but for some representatives (*S. matsudana* Tortuosa*, S. capusii, S. argeraceae, S. elaeagnos, S. viminalis* Ternopilska), the rooting ability of cuttings was more than 85%, with a length of cutting material of approximately 20 cm.

Grafting of planting material in nurseries is carried out only for standard forms and clones of the genus *Salix*. At the same time, Pravdin L. F. [33] carried out grafting of *S. caprea* by the method of copulation onto the rootstock of *S. dasyclados*. Grafting was carried out in the second decade of February, and the plants were stored in the snow until spring planting.

A new and promising method of propagating ornamental plant taxa and their forms is the method of microclonal plant propagation, which makes it possible to obtain a sufficient amount of healthy genetically homogeneous planting material regardless of external factors. In vitro culture of plant organisms of the genus *Salix,* along with cuttings, is attracting interest. The technology of isolated tissues has certain advantages: it is the only way to produce viable planting material of promising varieties and their decorative forms. This method provides a high reproduction rate [33].

Salix has long been attributed magical properties - protection from all kinds of misfortunes and evil spirits; it was used to treat headaches, rheumatism, fever, gastrointestinal diseases, etc. [13]

The meaning of the worship of *Salix* is that the tree should convey strength, health and beauty to the human body or animal. This custom existed among various nationalities. It was carried out in the vast majority in the spring, when the vegetation period begins for trees, they bloom, gain energy themselves and, according to belief, are able to transfer it to others.

The sacred *Salix* is highly revered among the Ukrainian people. "It is a sin to trample on a consecrated *Salix*," and therefore even the small shoots that remained after consecration were burned on fire [9]. Consecrated *Salix* branches were given magical power. In the spring, cattle were beaten with consecrated *Salix* branches - "so that evil spirits would not cling to the animals." In addition, consecrated *Salix* branches were thrown out into the street during hail - "to stop the hail" [18].

Salix has a special significance in medicine. In case of diseases of people or animals, folk healers boiled consecrated *Salix* together with herbs and gave such liquid to drink to the sick animal or person - in the full sense that it would help. The head is washed with the infusion of consecrated *Salix* and this is used to treat headaches. In addition, consecrated *Salix* is used to treat rheumatism and fever, and fever symptoms are reduced.

Crushed *Salix* leaves are sprinkled on wounds, and tinctures from the leaves are used for intestinal diseases. In addition, it is also used in medicine. *Salix* bark in light infusions is used for rheumatic pains of muscles and joints. In this case, it is best to drink its infusion for 15 days. Decoctions of the bark are used for fever and febrile conditions associated with high nervous tension. The bark of white *Salix* is part of some medicines (passiflorin).

S. caprea, a taxon of *Salix*, is used for medicinal purposes.

According to popular belief, *S. caprea* was cursed by God because it was used to make nails for the cross on which Jesus Christ was crucified. In addition, according to legend, an evil spirit resides in the dry wood of *Salix*; hence the saying: "I fell in love with a dry willow like the devil!" *S. caprea* is widely distributed in Ukraine, especially in wooded areas. It is characterized by " catkins ", as well as short and wide leaves.

Figure 9. Salix bark

Bark (Fig. 9) is harvested for extract production at the end of the growing season, and from *Salix triandra* - from the beginning of August, when the bark contains the largest amount of tannin. To obtain bark, 2-4-year-old *Salix* trees and branches are cut and sprinkled with soil mixture. In the spring, they are placed in water, after which the bark is harvested, which is easily separated from the stem. The collected bark is dried in the shade. In this case, the tannin content in the bark should be more than 6%, its optimal humidity is 16%, and it should not contain wood. During the raw material procurement period from October 1 to May 1, bark with a moisture content of up to 21% is allowed to be purchased. It must be free of signs of mold and rot, and must not have wormholes. The outer side of the bark should be longitudinally grooved, rough or smooth, gray, brown or grayish-green in color, and the inner side should be smooth, clean, without wood impurities, bright pink, bright straw, bright brown in color. Raw materials are accounted for in tons, and the calculation is made for a bark moisture con-tent of 16%.

For medical purposes, *Salix* bark is harvested in early spring before the phase of swelling and budding, when it easily lags behind the wood. On last year's branches, bark incisions are made every 30 cm, and the bark is easily removed. After removal, the raw material is immediately dried on a cloth, spreading it in a thin layer. The bark is dried under a canopy. The dried medicinal raw material does not bend, it breaks with a crack. At the same time, impurities are excluded from the material.

Figure 10. Furniture

For the production of furniture (Fig. 10) *Salix* rods are used, which are peeled from the bark, with a thickness of the lower cut up to 11 mm, as well as peeled sticks with a thickness of 1.2 to 4.5 cm.

Figure 11. Use of Salix vines

In the manufacture of wickerwork (household items (Fig. 11), baskets, women's handbags) peeled *Salix* rods with a thickness at the base up to 20 mm are taken. The vine is harvested in the autumn-winter period. At the same time, for production purposes, one-year growth is taken, which should be even, flexible, without damage and knots. To remove the bark, the vine (one-year growth) is tied into bundles and placed in a reservoir to provoke sap flow, while the bark is easily separated. In specialized workshops, before removing the bark, the one-year-old growth is treated with hot steam or boiled in cauldrons. The prepared rod eventually acquires a brownish-pinkish color from the coloring and tanning compounds contained in the bark. The vine is bleached with chlorine or sulfuric acid. *Salix* moisture content of raw materials for wickerwork should be 14-16%, and *Salix* moisture content in finished furniture should not exceed 17%.

Conditions and methods of conducting research. Research on the cultivation of *S. matsudana* planting material for landscaping was carried out in the conditions of the cultivation facility and open ground of the Edelweiss garden center in 2025.

The material for growing plants with an uninjured root system was stem microshoots (Fig. 12). Cuttings were harvested from trees approximately 15 years old.

Figure 12. Planting material

Planting material was harvested from the medial part of a one-year-old branch before the bud swelling phase. The size of the cutting was 13-15 cm. In addition, they were placed in water for 3 hours. Rooting of the planting material was carried out in a greenhouse, where 1.0 l containers were placed. The pots were filled with a substrate that included peat and river sand. 100 pcs. cuttings were planted for each option.

The experimental design included options where the factors were the thickness of the planting material and the degree of light supply. The planting depth of the planting material was 10-11 cm.

The studies were conducted according to the following scheme:

Factor A – natural light conditions: 1) control (5 mm); 2) 7 mm; 3) 10 mm; 4) 13 mm. Factor B – shading conditions: 1) control (5 mm); 2). 7 mm; 3) 10 mm; 4) 13 mm.

At the end of May, pots with cuttings were moved to open ground, where they remained until the end of the growing season.

In the second decade of September, measurements of morphometric indicators of grown plants were carried out: the size of the aboveground part, the mass of the root and aboveground system.

The research was carried out according to the methodology for plant propagation [3, 27].

Research results. The root-owning method of propagation for many plants is the only means of preserving valuable properties and characteristics, and also intensifies the process of growing high-quality planting material.

There are artificial reproduction, which occurs under the influence of human activity, and natural, which is carried out without the human factor. During vegetative reproduction, all biological and economically valuable features and characteristics are transmitted to the generation, which provides the opportunity to reproduce plants and their decorative forms. The process of root system formation is considered as a complex of various histological, physiological and biochemical processes [32]. At the same time, roots in microshoots are formed in different tissues. In lignified microshoots, roots appear in the cambium zone.

The main importance for coregenesis in stem microshoots and their further growth is played by climatic factors (lighting, temperature, humidity of air and substrate) and edaphic factors, and therefore it is necessary to create favorable conditions for the growth and development of cuttings.

According to the results of the search work, a corresponding dependence was found, that with an increase in the thickness of microshoots, the height of the planting material improves (Table 1 and Fig. 13).

When using cuttings with a diameter of 5 mm, the height of the plants was within 42.0-58.0 cm, while in the experimental variant (13 mm) - 84-177 cm, which is 2-3.1 times less. At the same time, a significant difference was recorded between the experimental variants and the control. Considering the above, according to the results of the information obtained, it was found that planting material with a thickness of 10-13 is optimal.

Table 1. The influence of some factors on biometric indicators of plants

Option	Lighting Level	Indicators				
		Plant height, cm	Weight, g			
			roots	% to control	above-ground part	% to control
Control (5)	Shading	42,0	5,4	-	6,3	-
	Natural Lighting	58,0	8,09	+ 149,8	21,76	+ 345,4
7	Shading	68,0	9,7	-	13,4	-
	Natural Lighting	72,0	12,44	+ 128,2	32,95	+ 245,9
10	Shading	79,0	12,7	-	21,6	-
	Natural Lighting	104,0	18,25	+ 143,7	48,49	+ 224,5
13	Shading	84,0	16,9	-	29,1	-
	Natural Lighting	177,0	29,13	+ 172,4	66,25	+ 227,7

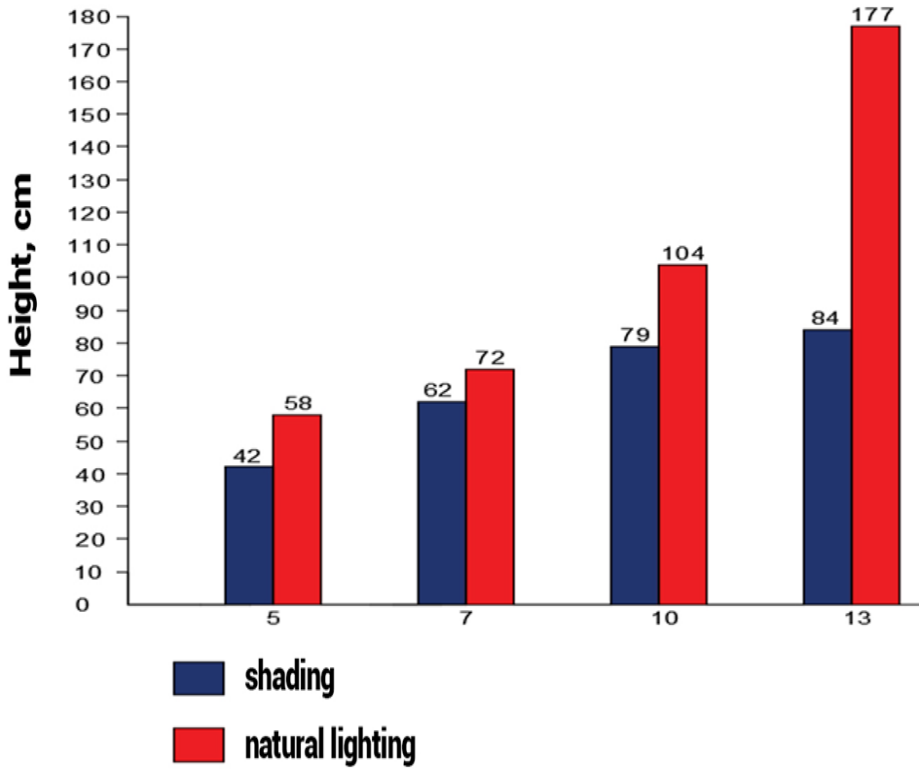

Figure 13. Height of S. matsudana plants under different growing conditions

In addition, it is advisable to pay attention to the fact that the intensity of lighting of planting material affects the size of plants.

Thus, it can be said that the degree of illumination and the thickness of the cuttings play a significant role in improving the quality of planting material.

In addition, the study examined the relationship between the thickness of the planting material and the mass of the root system (Fig. 14). When harvesting cuttings with a thickness of 13 mm, the weight of the root system was 16.9-29.13 g, which was 21.04 and 11.5 g higher than the control variants, where microshoots with a thickness of 5 mm were used. At the same time, the reproductive ability of the variants was reliable.

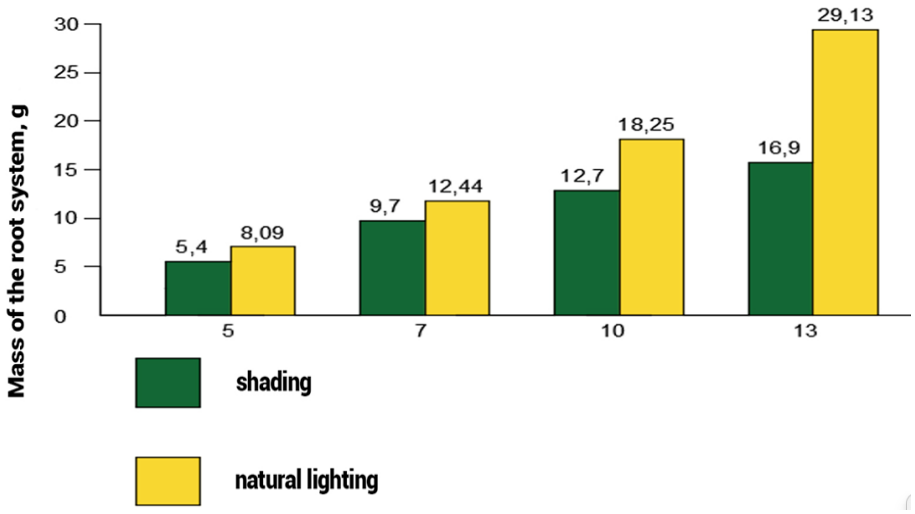

Figure 14. Weight of the root system of S. matsudana plants

According to the table, it can be stated that the weight of the root system of planting material is affected by the degree of light availability and the thickness of the planting material. Thus, microshoots with a thickness of 13 mm form a branched root system compared to the variant where cuttings with a thickness of 5 mm were planted, which accordingly affects the growth processes of *S. matsudana* plants and the absorption of nutrients.

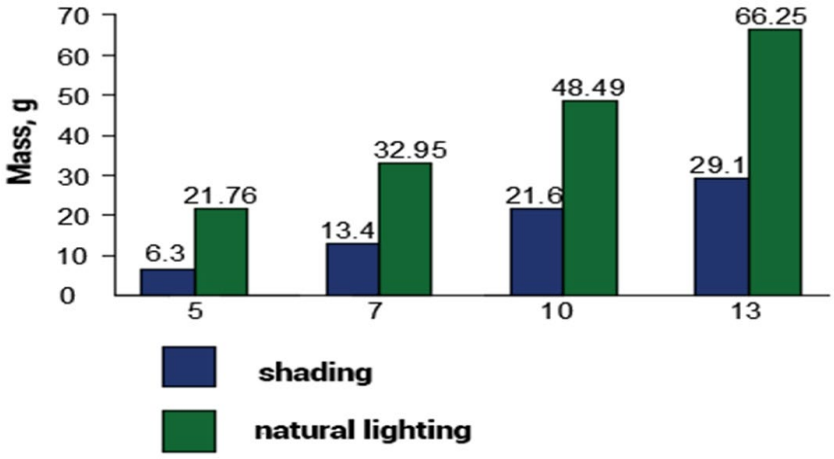

Figure 15. Mass of the above-ground part of the planting material

In the process of analyzing the influence of cutting thickness and degree of light supply on the mass of the aboveground part of *S. matsudana* self-rooted seedlings (Fig. 15), a significant difference between the variants was recorded. The weight of the aboveground part of the plants ranged from 6.3 to 66.25 g. The mentioned indicator in the search variants was 22.8-44.49 g higher compared to the control.

It was found that the plants of the control variant had a worse named indicator than the experimental ones. In the process of research work it was found that under optimal lighting conditions and an increase in the thickness of the cutting material, an improvement in the weight of the above-ground part occurred, which had a corresponding role in biochemical processes, such as the exchange of organic compounds and photosynthetic activity, and also provided favorable conditions for the further development of the plant organism.

Thus, it can be said that the thickness of the planting material and growing conditions have a significant impact not only on the height of *S. matsudana* plants, but also on their weight. It was found that the maximum plant sizes were found in the search variant, where the thickness of the planting material was 13 mm.

From the above, it is reasonable to conclude that under the conditions of own-root cultivation of planting material with an uninjured root system, it is necessary to plant microshoots 13 mm thick.

The genus *Salix* is numerous and complex in its taxonomy. Its taxa readily cross-pollinate with each other, forming hybrid forms that are difficult to identify. In addition, approximately 350 representatives of the genus are known, several of which are widely used in landscaping [9, 14-15, 17, 19].

Salix is an unpretentious tree or shrub used in ornamental gardening for landscaping parks and squares.

Long before the advent of the Christian religion, people revered *Salix.* Its shoots were used as a remedy against evil spirits, and a broom made of branches served as a talisman in the house. Special importance was attached to this breed, since it was believed that it has great vital energy, blooms earlier than other trees, and also receives spring energy from the sun.

Figure 16. Salix in design

Especially good conditions are for *Salix*, where there is moisture, near large or small reservoirs (Fig. 16). It is valued for its fairly intensive growth and original crown shape, which allows it to be used in creating appropriate garden and park compositions [22].

Figure 17. Single plantings of S. matsudana

S. matsudana has a spreading crown and drooping shoots. It looks great both in single plantings (Fig. 17) and in compositions (Fig. 18). This plant will decorate the site in the English style, which involves asymmetry, maximum approximation to the natural environment, as well as free planning.

Figure 18. Group plantings of Salix

Before planting *Salix*, it is necessary to choose a place in the garden plot. Decorative taxa require sheltered from the wind, slightly shaded or sunny places.

With a lack of light, *Salix* grows satisfactorily, in decorative-deciduous forms the color of the leaves loses its saturated color. It feels good on nutritious, aerated and moist soils with close groundwater levels.

The retail network mainly sells planting material with an undamaged root system, which is planted during the growing season - from the third decade of March to the first decade of November. At the same time, the earthen lump should not be dry, as this affects the survival of the seedlings. Planting material with an open root system requires planting before the buds swell and bloom or in the second decade of October. Highly decorative forms with relatively poor winter hardiness are recommended to be planted in the spring season so that they can grow stronger during the summer. The root system of the planting material should be freely placed in the planting pit. To improve soil fertility, humus is added to the pit. After planting, the soil is compacted and watered abundantly.

The soil around the seedlings is mulched with humus with a layer of about 10 cm. Mulch creates optimal conditions for growth and also prevents intensive evaporation of moisture.

During periods of drought and heat, *Salix* requires intensive watering, it is advisable to spray the crown of weeping forms, *Hakuro Nishiki* especially likes a “shower”.

After planting, the planting material is sensitive to moisture deficiency, and therefore in the first year requires constant irrigation. Drying of the soil is not allowed.

The vast majority of *Salix* cultivars and ornamental forms are quite winter-hardy, but in conditions of low winter temperatures, the shoots of young plants may freeze. To avoid the aforementioned problem, it is advisable to insulate young plants for the first 3 years.

Ornamental *Salix* look attractive if fertilized every year. The amount of nutrients depends on the size of the tree, its growth rate and soil fertility.

The first feeding with complex fertilizer is carried out at the end of March after pruning, and the next time - in the first decade of July. Humus or long-lasting fertilizers are applied once during the growing season – the third decade of March, since use at a later date worsens the winter and frost resistance of trees. An important element of *Salix* care is pruning, which strengthens the tree, improves its condition and creates the opportunity to form a crown. Without the above-mentioned technological operation, the plant forms an unattractive crown that loses its decorativeness.

Crown formation begins in the first growing season after planting the planting material. *Salix* tolerates pruning well, which stimulates the growth of new lateral branches and limits excessive growth. The technological operation is carried out at any time of the year, but it is best to carry out a strong shortening of the shoots in spring before the leaves appear.

After planting the seedlings, the branches are cut, leaving about 0.20 m in length or a few buds at the base. The cut is made slightly above the growth point, about 4 mm.

In subsequent seasons, all shoots of bush *Salix* are pruned to the point where they started their growth last season. The plant will respond to annual pruning with abundant flowering and intensive growth.

Vertical shoots of trees are removed in spring, leaving a central conductor. During the growing season, after pruning, the tree gives a powerful growth of new shoots, forming a dense, highly decorative crown. Cuts of large branches are covered with garden pitch or oil paint with the addition of topsin.

Standard *Salix* are pruned several times during the warm season, but the last cut is made at the end of the third decade of July.

Technological measure ensures crown compaction, stimulates the growth of new shoots. In weeping forms, branches are shortened to length depending on the needs of the owner.

To maintain the phytosanitary condition of *Salix*, sanitary pruning is also carried out. The thickened crown is thinned out so that the tree receives enough light, and diseased, weak and damaged branches are removed. After pruning, it is advisable to water and fertilize the tree abundantly.

Systematical removing of the root growth that grows from the root system of trees grafted onto the stock is recommended.

Conclusions and Suggestions

1. The climatic and soil conditions of the Sumy region are favorable for the production of *S. matsudana* planting material.

2. *S. matsudana* should be propagated by lignified microshoots, which are harvested from the middle part of the branch before the bud swelling phase. The optimal length of planting material is 13-15 cm.

3. It has been proven through research that the quality indicators of the planting material of the experimental species are influenced by the thickness of the cutting and growing conditions.

4. Under conditions of insufficient lighting, the height of the plants was within 42.0-84.0 cm, which is 17.0-93.0 cm less than in the search options.

5. When harvesting cuttings with a thickness of 13 mm, the mass of the above-ground part was 29.1-66.25 g, which is 3.05 and 4.62 times more than planting material with a thickness of 5 mm.

6. *S. matsudana* is a fast-growing tree species, which is used to form recreational areas as single and group plantings.

For growing *S. matsudana* planting material, we suggest preparing cuttings 10-13 mm thick. Given the botanical and ecological characteristics of this taxon, it is necessary to use it when creating recreational facilities.

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