



## VEGETATIVE REPRODUCTION OF SEA BUCKTHORN (*HIPPOPHAE RHAMNOIDES* L.) IN THE TASHKENT OASIS

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### Abstract

*Sea buckthorn (Hippophae rhamnoides L.) in the plant world is a leader in the variety of useful properties and their practical use. The introduction of a new type of forestry production in Uzbekistan sea buckthorn plantations involves the formation of new approaches to growing own-rooted seedlings and vegetative propagation of promising forms of sea buckthorn. The aim of research was to study the vegetative propagation capacity 6 ecotypes buckthorn local populations and varieties of "The Gift of the Katun" (Russia) in the open field and in greenhouses conditions automatically controlled artificial fog. Studies have shown that sea buckthorn cuttings characterized by a high regenerative capacity in their rooting in the open ground. Best indicators seedling growth was observed in the fertile soil of (74,1±4,59 cm of height 16,8±0,3 mm in diameter) the worst - in normal soil (43,3±1,41 cm and a height of 3,0±0,12 mm diameter). The share of standard seedling is high among seedlings grown in the fertile soil (73,1%), low - in ordinary soil and 25,0% in the open sandy greenhouse (25,9%). Cuttings varieties of sea buckthorn "Dar Katun" better rooted in the sandy substrate (81,2-82,4%) but grow better in fertile soil - at the end of the growing season, they had a height of 78,7±3,98 cm and 6,8±0,25 mm diameter. It is better to take root cuttings Paltaus (78,6%) and Chirchik ecotypes (77,5%). Worse rooted cuttings Tanhazardaryans ecotype (64,5%). Preservation of seedlings of various ecotypes at the end of the growing season was 74,5-81,4%.*

*Keywords –population, ecotypes, riparian plant communities, edificator, woody cuttings, own-rooted seedling, the callus, rooting*

### I. INTRODUCTION

Sea buckthorn (*Hippophae rhamnoides* L.) vegetable world is a leader in the variety of useful properties and their practical use. Sea buckthorn in Russia and China, is grown in plantation crops, the fruits are used for jelly, wine drinks, natural juice, powder additives and confectionery bakery products. From sea buckthorn in China produced more than 200 different food health and beauty products. Great practical interest for the food industry is Sand thorn flour. Sea buckthorn meal - a by-product of processing of fruits of sea buckthorn, a valuable high-energy raw materials.

Sea buckthorn fruit consists of sugars, sugar alcohols, fruit acids, vitamins (C, E, and K), phenolic compounds, carotenoids, fiber, amino acids, minerals, and plant sterols. The fruit contains many of these in high amounts, so is considered highly nutritious [2].

Major sugars in sea buckthorn fruits are fructose and glucose, with total sugar content of 2.7-5.3 g/100 ml of juice. Typical sourness of the fruits is due to high content of malic acid (0.8-3.2 g/100 ml of juice) while astringency is related to quinic acid (1.2-2.1 g/100 ml of juice). Major sugar alcohol in fruit is L-quebrachitol(0.15-0.24 g/100 ml of juice).

The fruit of the plant has a high vitamin C content – in a range of 114 to 1550 mg per 100 grams with an average content (695 mg per 100 grams), placing sea buckthorn fruit among the most enriched plant sources of vitamin C. Additionally, fruits have high concentrations of carotenoids,

vitamin E and vitamin K. The main carotenoids are beta-carotene, zeaxanthin and lycopene while alpha-tocopherol is the major vitamin E compound.

The fruit is also rich in plant sterols (340–520 mg/kg),  $\beta$ -sitosterol being the major sterol compound as it constitutes 57–83 % of total sterols.

Flavonols were found to be the predominating class of phenolic compounds while phenolic acids and flavan-3-ols (catechins) represent minor components [1,5].

Buckthorn bark is also used for medical purposes. It is dried, crushed and taken orally. It contains an alkaloid gipoffein, having in its composition in the bound form of the serotonin (up 1%), which has a moderate antitumor activity.

Sea buckthorn valuable forest reclamation plant, it secures its numerous root suckers eroded, degraded land and enrich them with nitrogen, learning it from the atmosphere by nitrogen-fixing root nodule bacteria in an average of 60-70 kg / ha per year [4].

Sea buckthorn in spite of the complex of positive qualities, has not yet found in Uzbekistan proper application, which is due to failure to promote it as a promising fruit crops and shortage of planting material and the absence of farming industrial cultivation. In connection with the ever-increasing demand for planting sea buckthorn, very acute question of how its reproduction. It reproduces both by seeds and vegetatively. To create a highly productive plantations require genetically uniform planting material of the best forms and varieties. It can be obtained only by vegetative propagation. A more simple and accessible is the sea buckthorn breeding woody stem cuttings.

## II. MATERIALS AND METHODS

To identify the possible acceleration of hardwood cuttings of sea buckthorn in the conditions of the Tashkent oasis we have different experiences were laid. The experiments were conducted in the open field and greenhouse conditions, automatically controlled artificial fog Republican Scientific-Production Center of Ornamental Gardening and Forestry.

The climate of the plain area of the Tashkent oasis, where field trials were laid on the vegetative propagation of sea buckthorn, refers to the area of the foothills of the central part of Uzbekistan. Its territory is included in the Tashkent-Hungry depression. Its climate is typical of the upper terrace of the Chirchik River, characterized by an abundance of light and heat, and continental aridity. Plenty light and heat is provided by a long duration of sunshine, which here is 2800-2900 hours per year, reaching 360-400 hours in the summer and falling to 90-100 hours in winter.

The days without the sun is rarely observed in December and January - 10-25 for two months, from June to September - from 1 to 4 ten let. Duration frost-free period 216-230 days. The average date of the last spring frost, March 20-26, the first autumn - 19 October-6.

The duration of the period with average daily temperature 10°C-221 days, from March 25 to October 31. The average annual temperature 13-14°C January - -0,5-1,5°C July 27-29°C, the absolute minimum to -35°C, the absolute maximum 43-44°C. The continental climate is expressed in a long, dry and hot summer, wet spring, winter instability and sudden changes in temperature in the diurnal (13-18,5°C 5-10°C summer and winter) and the annual cycles (up to 30°C). aridity seen in the small total amount of precipitation, and the absence of their low relative humidity during the summer months.

The annual rainfall of 250-500 mm, mostly they fall in winter and spring, the wettest month - March. Relative humidity in winter -80-90%, summer - 30-40%. The number of days with humidity below 50% -180. The number of days with snow cover - 25-70 days. The snow cover unstable.

Soil research areas related to soil zone of foothill plains sloping serozem belt. The depressions occur hydromorphic - meadow and meadow-bog soils. Ground waters occur at a depth of 6-8 m. They are fresh, have a good flight. The texture of medium-loamy soils. The humus content in the arable (0-20 cm) horizon is 0,99-1,39%, in the subsurface (21-40 cm) - 0,88-0,91%.

The content in the arable horizon was as follows: total nitrogen -0,072-0,0087%, total phosphorus - 0,129-0,158% and total potassium - 1.65-1.85% of the arable layer. Provision mobile forms were as follows: nitrogen and phosphorus - is low (13,8-16,6 and 26,0-27,6 mg/kg) and potassium – average (228-340 mg/kg) of reproduction of sea buckthorn woody cuttings produced in the usual ridges and sandy substrates (sand, a mixture of turf earth, humus equal parts). The production - biologically method of reproduction woody cuttings is very promising, since the low cost of labor and resources allows for 1 year to grow mass amounts of genetically homogeneous standard own-rooted planting material.

Sea buckthorn characterized by high natural ability to form adventitious roots on woody shoots of all ages.

Woody shoots for cuttings harvested during natural dormancy - in early spring with high-yielding and large fruited form. Shoots garden shears cut. Harvested shoots are cut into cuttings 30 cm long using pruning shears. Before planting cuttings ready for 12-14 hours in water maintained.

Woody cuttings planted in open ground in well-lit areas of the prepared since autumn profoundly and cultivated the fertile soil, light in texture when planting cuttings attached to the vertical position, leaving above the soil surface -2-3 kidneys. The distance between rows 60 cm, in series between the shanks 12 cm (138,888 plants/ha). Care of cuttings is watering, weeding and soil loosening. Immediately after planting carried abundant watering. In the future, for good aeration, the soil in the open field contained in different state. By end of spring precipitation was carried out regular watering in such a way that the soil at the experimental plots was hydrated.

To study the dynamics of growth every 15 months the number of measurements made seedlings heights. The increase in diameter is measured only at the end of the growing season. seedlings preservation into account as of June 15 and September 20. The share of standard seedlings in gross output was determined in accordance with GOST 26869-86. (Ornamental shrubs seedlings. Specifications. Introduced to 4.04.86, Moscow, Publishing House of Standards, 1986). According demand of GOST buckthorn seedlings having a height of above-ground parts of more than 60 cm are considered standard seedlings.

### **III. RESULTS AND DISCUSSION**

Spring sprouts harvesting gives the best results for rooting and development of seedlings than autumn harvesting (79.3% vs. 28.5%). Better strengthened cuttings of 20-30 cm in length 84,6-89,6%. Worse rooted cuttings 15 cm long, 62.5%.

The best period of the high-rise on the rooting of cuttings is the early spring, but the soil at a depth of 15-20 cm should warm up to +5 C. Before the formation of root cuttings watered 2 times a week with a 4-5 formation growth of the upper renal units means that the cuttings We began to take root, and in this phase of irrigation rate decreases.

Studies have shown that sea buckthorn cuttings characterized by a high regenerative capacity in their rooting in open field conditions. The formation of adventitious roots on cuttings of sea buckthorn associated with callus. As a rule the roots laid in the cambium of the stem cuttings and breaking through the crust in the vicinity of the sheet or pillow between the callus and bark.

**Table 1. Rooting hardwood cuttings and seedlings of wild sea buckthorn growth in different substrates**

| Types of substrate                | Growth rates after growing seedlings |              | Rooting cuttings, % | Preservation of seedlings at the end of the growing season, % | The share of standard seedlings in gross income, % |
|-----------------------------------|--------------------------------------|--------------|---------------------|---|--|
|                                   | Height, cm                           | Diameter, cm |                     |   |  |
| Normal soil                       | 43,3±1,4<br>1                        | 3,0±0,12     | 70,3                | 84,2  | 25,0   |
| Fat land                          | 74,1±4,5<br>9                        | 6,8±0,31     | 74,4                | 82,5  | 73,1   |
| Outdoor sand greenhouse           | 53,3±2,4                             | 4,0±0,13     | 78,5                | 85,1  | 25,9   |
| The sand in the greenhouse in fog | 53,2±2,6                             | 3,8±0,05     | 80,4                | 87,1  | 54,3   |

Educated increase rapidly increases during the second half of summer. Shoots develop unevenly, usually from the top 2-3 of the kidneys. Leading to become one of them, others gradually stop growing. On the leading runners often develop side shoots summer.

The experiments studied the effect of different substrates on the rooting, growth and yield of standard seedlings. The best substrate of sand appeared, it 78,5-80,4% rooted cuttings planted sea buckthorn (Table. 1).

Cuttings planted rooted 70.3%, 74.4% of the fertile soil in ordinary soil.

The best performance was observed growth of seedlings in fertile soil (74,1 ± 4,59 cm and a height of 6,8 ± 0,3 mm in diameter) the worst - in normal soil (43,3 ± 1,41 cm and a height of 3,0 ± 0 12 mm diameter).

The share of standard seedlings is high among seedlings grown in the fertile soil (73.1%) in the conventional soil low - 25.0% and in the open sandy greenhouse (25.9%). Cuttings varieties of sea buckthorn "Dar Katun" better rooted in the sandy substrata (81,2-82,4%) but grow better in fertile soil -to end of the growing season, they had a height of 78,7 ± 3,98 cm and 6.8 ± 0, 25 mm diameter (see Table 2).

**Table 2. Rooting hardwood cuttings and seedlings growth of seabuckthorn varieties "Dar Katun" in a variety of substrates**

| Types of substrate                | Growth rates after growing seedlings |              | Rooting cuttings, % | Preservation of seedlings at the end of the growing season, % | The share of standard seedlings in gross income, % |
|-----------------------------------|--------------------------------------|--------------|---------------------|---|--|
|                                   | Height, cm                           | Diameter, cm |                     |   |  |
| Normal soil                       | 44,5±1,6<br>5                        | 3,9±0,11     | 72,2                | 82,3  | 29,2   |
| Fat land                          | 78,7±3,9<br>8                        | 6,8±0,25     | 70,4                | 87,4  | 84,0   |
| Outdoor sand greenhouse           | 67,1±3,1<br>3                        | 3,8±0,16     | 81,2                | 86,6  | 68,0   |
| The sand in the greenhouse in fog | 40,6±2,6<br>4                        | 3,5±0,12     | 82,4                | 88,2  | 3,3  |

The best indicators for output of standard seedlings provided the seedlings grown in the fertile soil (84.0%) in the conventional worst - soil - 29.2%. Safety seedlings at the end of the growing season in all variants was 82,5-88,2%.

In the autumn of the first year of sea buckthorn seedlings are 40-80 cm (120 cm) tall, 3-4 lateral branching. Survey and study of the peculiarities of the root systems of annual seedlings sea buckthorn showed that the length of lateral roots of 30-35 cm (with a diameter of 0.8-1.0 cm). In July, the growth of seedlings growing in fertile soil accelerated.

The experiments also used cuttings 6 major ecotypes of wild sea buckthorn in Uzbekistan Chirchik, Zama, Paltaus, Zarafshan, Huzhakurgansay and Tanhazdaryan. It is better to take root cuttings Paltaus (78.6%) and Chirchik ecotypes (77.5%). Worse rooted cuttings Tanhazdaryan ecotype (64.5%). Preservation of seedlings of various ecotypes at the end of the growing season was 74.5 - 81.4%.

#### IV. CONCLUSIONS

1. In Uzbekistan buckthorn can be successfully propagated by rooting woody stem cuttings in open ground. It is better suited nurseries with fertile soil. All tested 6 ecotypes buckthorn showed highest rate rooting - 64,5-74,4%.
2. The best term harvesting cuttings is early spring before the start of sap flow in plants. Woody shoots for cuttings harvested in the end of the period of natural rest-at the beginning of March (in the mountains).
3. The best term planting cuttings in the rooting is early spring, but the soil at a depth of 15-20 cm should warm up to +5°C.
4. Share standard seedlings is high among seedlings grown in the fertile soil (73.1%) in the conventional soil low - 25.0% and in the open sandy greenhouse (25.9%).

#### BIBLIOGRAPHY

- [1] Andersson S.C., Olsson M.E., Johansson E., Rumpunen K. 2009. Carotenoids in sea buckthorn (*Hippophae rhamnoides* L.) berries during ripening and use of pheophytin a as a maturity marker. *Journal of Agricultural and Food Chemistry*. 57 (1): 250–258.
- [2] Bal L.M., Meda V., Naik S.N. Satya S. 2011. Sea buckthorn berries: a potential source of valuable nutrients for nutraceuticals and cosmoceuticals. *Food Research International*. Exotic Fruits: their Composition, Nutraceutical and Agroindustrial Potential. 44 (7): 1718–1727.
- [3] Berdiev E.T, Turdiev S.A. 2013. The morphology of fruits and seeds suckers (*Elaeagnaceae* Lindl) // *Uzbek biological journal*, Tashkent, №5, pp. 34-37 (in russian)
- [4] Berdiev E.T, Turdiev S.A., Karimov M.R. 2013. Mycorrhiza-forming fungi in the roots suckers (*Elaeagnaceae* Lindl) // *Bulletin of agrarian science of Uzbekistan*, Tashkent, №2 (52). p. 77-79. (in russian)
- [5] Zheng, Jie; Yang, Baoru; Trépanier, Martin; Kallio, Heikki (2012). "Effects of genotype, latitude, and weather conditions on the composition of sugars, sugar alcohols, fruit acids, and ascorbic acid in sea buckthorn (*Hippophaë rhamnoides* ssp. *mongolica*) berry juice". *Journal of Agricultural and Food Chemistry*. 60 (12): 3180–3189.