Planting dates and placement of the Sophora plantation on the irrigated lands of the Tashkent oasis

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Abstract. This article is very relevant to set out organizing plantations in the conditions of the Tashkent oasis. Climatic zones of desert and semi-desert under the influence of new conditions (abundance of light and thermal solar energy, a very long growing season, artificial irrigation), the growth and development of sophora is favorable. Annual seedlings under the influence of mineral fertilizers reach a height of up to 110 cm, the growth of lateral shoots of seedlings in the first year after planting is 33 cm. In the conditions of the Tashkent oasis, sophora favorably tolerates short-term winter low air temperatures (up to 30°C), tolerates soil compaction and has established itself gas-, dust-resistant decorative breed. The number of inflorescences on one tree ranges from 16 to 60 pieces, depending on the layout of the seats. Abundant flowering of sophora was noted with a planting pattern of 5.0x4.0, 5.0x3.0 with sufficient sunlight. The content of rutin in fruit elements ranges from 3.9 to 14.7% and depends on agrotechnical care, the state of the plantings themselves and their location.

1. Introduction

Uzbekistan is distinguished by a wide variety of natural conditions [1, 2]. The whole republic is characterized by a pronounced continentality of the climate, high summer and low winter temperatures, dry air, sharp fluctuations in daily temperatures, a large annual sum of positive temperatures (4000-6000°C), a low amount of precipitation during the growing season (20-130 mm) and enormous evaporation hot winds often blow in the dominant part of the territory in summer and cold in winter. All these climatic factors are not very favorable for green building, and if you do not approach the planting carefully, then they adversely affect the growth and development of trees and shrubs [2, 3].

Sophora Japanese has long been known in many countries with a temperate climate. Naturally, it grows in the forests of North China, Korea and Japan. In our country [3, 4], they began to breed it in the Nikitinsky Garden since 1814. From here they spread widely across the Crimea, Krasnodar Territory, Kherson and Odessa regions. In Uzbekistan the sophora was introduced in the middle of the 18th century. It was used in protective plantings, in crops, and especially widely in urban plantings. Currently, there are more than 100 thousand abundantly flowering and fruiting trees in Tashkent [5].

Sophora japonica is a fast-growing, light-loving, salt-tolerant and relatively drought-resistant deciduous tree of the legume family. In favorable conditions, it reaches a height of 25 m and more with a wide spherical crown. Buds are light greenish -white, oblong-ovate, 4-6 mm long, 2-4 mm in diameter, collected in conical loose inflorescences - panicles. Flowers are 1-1.5 cm long, yellowish-
white, aromatic. Fruits are clear-shaped succulent beans containing 6 seeds of dark brown or black color [6-8].

It has been established that Japanese sophora buds are sources of industrial rutin, which, like vitamin P, increases the body's ability to absorb vitamin C, and reduces fragility and capillary vascular permeability. Sophora tincture is used in medicine for washing purulent cavities and wounds, in the treatment of trophic ulcers, paraproctitis, liver and stomach diseases, chronic pleurisy, angina pectoris, colitis, gastritis, gum disease, fungal diseases, eczema [7]. According to Bulgarian scientists, sophora preparations are used to treat and prevent hemorrhages of toxic origin (poisoning with arsenic compounds, salicylates) and a number of other diseases [8].

The medicinal properties of sophora are still poorly understood, however, according to the information known to science, we can talk about its great future [2]. At the same time, there are still no scientifically substantiated recommendations on the technology of creating a sophora plantation for obtaining medicinal raw materials.

2. Materials and Methods
Currently, the Tashkent Chemical-Pharmaceutical Plant, where rutin is synthesized from sophora buds, receives raw materials from abroad. Moreover, often the quality of raw materials for the main indicators (the content of organic and mineral impurities) does not meet the factory requirements. In this regard, we set up field experiments in the arboretum of Tashkent city (the territory of the experimental base of the Research Institute of Forestry and Agriculture of the Republic of Uzbekistan) to obtain the influence of agricultural cultivation methods on the yield and growth of sophora.

After leveling and preparing the soil, one-year seedlings were planted in two terms (in the fall and spring of the next year) with a layout of 3.0x2.0; 3.0x3.0; 3.0x4.0; 4.0x4.0; and 5.0x5.0 cm. At the same time, mineral fertilizers were applied at the rate of N90P60K30 1 ha in two terms immediately after planting; in another variant – N45P30K15 after planting and N45P30K15 during leaf opening. Fertilizers were applied around the trunk to a depth of 15-20 cm at a distance of 20-25 cm from the plants. During the growing season, furrow irrigation was carried out five times, following by four times loosening between furrows and three times in ridges.

3. Results and Discussion
The observation results showed that in the first growing season the sophora gives a slight increase in height and is 15-23 cm. There were no sharp differences in the growth of plants at different planting dates, although some advantages of autumn planting over spring planting are noticeable (Table 1).

| Sowing dates | Survival capacity, % | Growth | Growth of side shoots, cm |
|--------------|----------------------|--------|-------------------------|
|              |                      | By height, cm | By diameter, mm |
| Autumn 2017  | 89.4                 | 151.3   | 15.0                    |
| Spring 2018  | 85.1                 | 145.2   | 13.2                    |
|              |                      |         | 27.3                    |
|              |                      |         | 23.9                    |

Mineral fertilizers in the first year did not have a significant effect on plant survival and growth, in height and diameter. As for their influence on the growth of lateral shoots, in the variant with fertilization in two periods, the increase was 33.4 cm, in the control it was 7.0 cm lower (Table 2).

To clarify the influence of the layout, planting site, places on the formation of fruit elements and plant growth, depending on the application of fertilizers, we also studied existing adult plantings, plants planted on test plots.
Table 2. The effect of fertilizers on the growth of side shoots

| Experience options            | Survival capacity, % | Growth | Growth of side shoots, cm |
|-------------------------------|----------------------|--------|---------------------------|
|                               |                      | By height, cm | By diameter, mm |                     |
| The control                   | 87.0                 | 147.3   | 14.3                      | 26.3                |
| One-time application          | 86.3                 | 155.1   | 15.7                      | 29.1                |
| Two times application         | 87.9                 | 157.7   | 15.6                      | 33.4                |

Test plot #1 was laid in the north-eastern part of the city of Tashkent. The site is circular and covers an area of about 0.25 hectares. Sophora was planted in the form of a grove. Soil preparation was carried out manually and consisted of digging planting holes 50x50 cm in size. The seedlings were planted in spring. Due to the fact that the plot is circular and the planting rows were directed radially from the cut to its middle, the trees are unevenly placed. Closer to the center of the site, the planting was carried out according to the scheme 4.0x3.0; 3.0x2.0 and to the edges - 5.0x4.0; 5.0x3.0 m.

In the first four years, agrotechnical care was carried out for the plantings, which consisted in loosening the soil around the trunk and irrigating along the furrows. From the age of five, only watering was carried out. The general condition of the sophora in this area is good, the safety of trees is 78.5%, they all bear fruit, although the degree of fruiting is uneven and depends on their location. In this regard, we have chosen several model trees after measuring the height, trunk diameter and crown.

Model trees were selected depending on the placement of planting sites; the number of side branches with inflorescences and inflorescences on each tree was counted separately.

The results of the survey showed that the height of sophora trees at the age of 18 years is 6.35-6.60 m. The trunk diameter at the height of the chest is 18-20 cm (Table 3), i.e. the arrangement of trees does not have a special effect on the growth of plantations.

Table 3. The growth and number of inflorescences of Japanese Sophora, depending on the age of the plantings and the placement of planting places

| #    | Location                  | Age, years | Layout of trees, m | Growth                  | Quantity in one tree |
|------|---------------------------|------------|--------------------|------------------------|----------------------|
|      |                           |            |                    | By height, cm | By diameter, mm | By crown diameter, mm | Branch sides with inflorescence | pcs | Inflorescence pcs |
| 1    | Cherdantsev-2 massive     | 18         |                    | 5.0-4.0    | 6.35          | 19.3                | 520                     | 13  | 60                  |
|      |                           |            |                    | 5.0-3.0    | 6.40          | 20.1                | 489                     | 14  | 51                  |
|      |                           |            |                    | 4.0-3.0    | 6.50          | 19.0                | 460                     | 12  | 33                  |
|      |                           |            |                    | 3.0-2.0    | 6.60          | 18.7                | 410                     | 9   | 20                  |
| 2    | Yunus-Abad massive        | 8          | 4.0-4.0             |            | 2.5           | 8.0                 | 380                     | 13  | 32                  |
| 3    | Along the ring road       | 9          | 2.5-4.0             |            | 3.2           | 10.5                | 350                     | 10  | 16                  |

However, the largest number of branches and inflorescences on one tree (60 pcs.) When placing planting places 5.0-4.0 m with a closer arrangement of plants in a row and between rows, the number of inflorescences sharply decreases and all buds on one tree are not air dry exceeds 450-500 g.
Test plot #2 was laid in linear plantings on the Yunusabad massive and was laid in the direction of the Megaplanet shopping mall, in the form of a plantation.

Yunusabad in early June, during the period of mass formation of sophora buds. Here it is planted with two-year-old seedlings in two rows along the street. Ahmad Danish. Planting was carried out in the early spring of 2018 along pre-prepared planting holes with placement at a distance of 4 m between rows and 4 m in a row.

The first year of planting maintenance consisted only of watering (imported water). The following years, the departure was practically embellished. The condition of the trees in the strip is satisfactory, despite the compaction of the soil around the trunk and the lack of regular watering. At the age of 8 years, the trunk height is 2.5 m, the crown diameter is 3.2 m, some specimens bloom profusely, and however, the number of inflorescences on one tree does not exceed 30-35 pieces.

Test plot #3 was laid along the ring road, opposite the Institute of Irrigation and Mechanization. The plot is 230 m long and 60 m wide and consists of 22 rows. Here, in 2017, Japanese sophora was planted with two summer saplings in the form of a grove between the Tashkent Ring Road and the buildings of the Irrigation Institute, perennial plantings of sophora were planted at a distance of 2.5 m, between rows and 4-5 m in a row. In the first two years, non-moldboard plowing between rows (in spring and late autumn) and loosening around the trunk were carried out. The plantations were watered along the furrows. Currently, tree care is only about watering. The crowns of trees are closed, pest infestation, dry tops are not observed. However, due to the close arrangement of row spacing (2.5), buds and other fruit elements are formed mainly in the upper part of the crown. Where the crowns of the trees are closed, fruit elements are practically absent or only underdeveloped single specimens are found. In addition to examining adult plantings of sophora, we have studied the methods of growing planting material in nurseries of agricultural ornamental gardening.

In the first branch, located in the arboretum, large-sized sophora seedlings were annually grown for landscaping populated areas. Seed collection was carried out manually in urban plantings (in December). The beans, after cleaning from impurities, were mixed with wet sand and poured into a pit 100x60x200 cm in size, covered with a thin layer of sand on top. After 15-20 days, the seeds were mixed and filled with water. They were sown in early spring to a depth of 3-4 cm with a seeding rate of 10-12 g per 1 ha of p.m.

In the first year, the sowing department was watered 8-12 times along the furrows, loosened and applied mineral fertilizers at the rate of N_30P_90K_60. Seedlings at the end of the year reached a height of 60-70 cm and more. They were then dug up and transplanted into the school department with 210 cm between rows and 25 cm in a row. Saplings are sold in 3-4 years.

To reveal the dependence of the growth of one-year seedlings and 3-year-old seedlings on the shortness of watering and the introduction of mineral fertilizers, we laid trial plots in the first branch of the nursery, where agrotechnical care was carried out. In the sowing department (sierozem soils), after sowing seeds at the beginning of April 2017, mulching with sawdust, 10 furrow irrigations, six-time cultivation and 4 weeding was carried out during the growing season. In addition, in May and June, mineral fertilizers were introduced in the form of top dressing N_30P_90K_15. The observation showed that the seedlings at the end of the year have an average height of 95.9 cm, the diameter of the root collar is 8 mm. The percentage of standard seedlings is 81%.

As you can see, seedlings grow very quickly from the first year. According to N.A. Kazanskaya. [5] in the arboretum of Kiev, sophora seedlings do not exceed 36-46 cm and dig them out at the end of the second year, when they reach a height of 84-197 cm, a diameter of 1.3-2.7 cm. In the school department, after transplanting seedlings at 3 years of age, large-sized seedlings had a height of 210-280 cm, diameter at the root collar 3.0-3.8 cm.

In such territories, there was a righteous experimental production check to test the suspended seeding rates of Japanese Sophora seeds with the introduction of fertilizers. The seeds were sown on March 20 in pre-cut ridges at a distance of 60 cm from each other at the seeding rate; 12; 24; 36 kg per ha. The annual rate of fertilizers N_30P_30 was applied before sowing and as top dressing - in May, June and early August. 4 weeding with loosening and 8 vegetation irrigations were carried out from May to
September. The results obtained showed (Table 4) that in all variants with the use of fertilizers, the growth of sophora is significantly higher than the control. The height of annual seedlings under the influence of fertilizers reached 97-110 cm, the diameter of the root collar was 6.0-7.0 mm, and the yield of standard seedlings was 86-87%.

**Table 4. Influence of mineral fertilizers and increased seeding rates on the growth of sophora seedlings.**

| Experience options | Seeding rate, g per 1 ha r.m. | Height, cm | Root collar diameter, mm. | Percentage of yield of standard seedlings |
|-------------------|-------------------------------|------------|---------------------------|------------------------------------------|
| Control           | 12                            | 80.80±4.16 | 6.10±0.24                 | 78                                       |
|                   | 24                            | 85.90±3.8  | 6.20±0.31                 | 83                                       |
|                   | 36                            | 64.2±3.92  | 5.60±0.21                 | 71                                       |
| N120P90           | 12                            | 110.8±3.90 | 7.49±0.25                 | 87                                       |
|                   | 24                            | 101.4±3.22 | 6.90±0.22                 | 86                                       |
|                   | 36                            | 97.4±2.52  | 6.50±0.21                 | 86                                       |

4. Conclusions

Taking into account the special value of the content of sophora in fruit elements, we collected the buds on trial plot #1 in multi-row plantings in the form of a grove and on the test plot #2 in urban linear plantings and submitted them for analysis to the Tashkent Chemical Pharmaceutical Plant Institute. The results of the analysis showed that rutin in the buds on the test plot #1 contain 14.7%, on the test plot #2 - 3.9%. Such a low routine yield in urban plantings, in our opinion, is due to the lack of proper maintenance of the plantings, dustiness and air pollution. In addition, the buds had a very pungent odor, a brownish yellow color, which does not meet the requirements of the plant.

In multi-row plantings, where in the first years the soil was cared for, the content of rutin, although it does not meet the requirements of the plant, is significantly higher than in linear plantings. Apparently, in order to increase the routine in the fruit elements of sophora, it is necessary to create special plantations with agrotechnical maintenance in them.

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