Technologies for growing *Magnolia Grandiflora* in forest nurseries: A case study of Uzbekistan

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**Abstract.** The article provides, according to the planting rate and phenological observations, the cultivation of annual saplings of *Magnolia grandiflora* when growing saplings from seeds. In order to accelerate the cultivation of young seedlings of the magnolia plant, work is underway to apply mineral fertilizers in various ways, and the results are recorded in a field journal. Experiments were carried out on a variation basis and 30 plant samples were obtained for each variation. In addition to the application of experimental fertilizers, additional preparations were used to protect our plants from various external influences: 1 g/1 of succinic acid was prepared from the roots and leaves in 5-7 days to remove leaves from stress. In addition to mineral fertilizers, organic (rotten manure) fertilizers were also used. The growth, development and characteristics of magnolia seeds were studied at the Andijan branch of the Research Institute of Forestry. As well as, growth rates, duration of ontogenetic cycles, moisture and mineral nutrition requirements, disease and pest resistance were also determined.

1. Introduction

During the years of independence, the cities of the Republic of Uzbekistan have made great progress in green building. However, for its further development, it is necessary to replenish the assortment with new stable, highly decorative trees. Very often, many plant species brought to the Republic from abroad are very difficult or not at all adaptable to the arid conditions of Uzbekistan.

At present, the growing interest of gardeners is shown in powerful flowering trees of the family, such as the tulip tree, paulownia and magnolia, which in the harsh continental climate turned out to be quite hardy. In the Botanical Garden named after F.N. Rusanov, a number of representatives of the Magnoliaceae family have been grown. This family is rich in decorative and economically valuable species [1]; therefore, it is of scientific and practical interest for expanding their introduction cultic range within the Republic. Hence, plants grown from seed or vegetative material of local reproduction are viable and stable in local conditions, which is the relevance of the proposed project. This is the aim of the order of the Cabinet of Ministers of the Republic of Uzbekistan dated October 16, 2012, number 683-F "On the widespread use of tulip trees and Crimean pine in landscaping cities and towns." For this purpose, 14 special nurseries for growing planting material of the tulip tree have been created in the Republic.

The complex of agrotechnical measures that accelerate the growth and development of these plants, as well as improve the germination of seeds [2-5], is aimed primarily at improving nutritional conditions through the use of fertilizers and growth substances, adherence to a certain irrigation regime [2]. Only
the right combination of these agricultural techniques will reduce the time for growing seedlings and seedlings of good quality of the above breeds.

An important link in the system of agrotechnical measures in modern forest nurseries is the use of mineral fertilizers. It is convenient to accept, it is possible with minimal labor costs to get from 1 hectare of forest nursery to 4 million seedlings [6-13]. For example, in the conditions of Belarus [7], the yield of standard planting material grown with mineral fertilizers increased by 25-30%. The economic effect from 1 hectare of the sowing department of the nursery sometimes reached 2 thousand rubles. (at 1972 prices). It should be noted that the efficiency of using mineral fertilizers is quite high, and only in those cases when nurseries use methods of growing plants and seedlings that provide all the necessary conditions for their growth: optimal humidity, sufficient aeration, absence of weeds, etc [14-16].

This project is aimed at developing an intensive technology for growing planting material of a tulip tree, paulownia felt, and magnolia for landscaping.

2. Materials and Methods

The soil and climatic conditions of the research area were studied. For this, in the selected areas, soil pits were laid to a depth of 2 m. The soil pits were described in shape and soil samples were taken. In soil samples under laboratory conditions, the content of humus, general and mobile forms of nitrogen and phosphorus, as well as some physical properties (field moisture capacity, volumetric weight and mechanical composition) were determined. The description of the soil and the selection of samples was carried out according to the generally accepted methodology in soil science. During the entire period of experimental studies, climatic indicators (atmospheric precipitation, humidity and air temperature, etc.) were studied at the nearest meteorological station (weather station "Andijan").

On the third program question for seed propagation of the tulip tree, pre-harvested seeds were used. Sowing of the tulip tree was carried out in late autumn, prepared in advance, which consisted of two parts: well-grounded old humus and one part of river sand. Before sowing, the seeds were treated for 8-10 hours with the growth substance heteroauxin at a concentration of 100-200 mg/l of water, and the control variant was treated with tap water.

On the question of determining the frequency and rates of application of mineral fertilizers when growing seedlings of *Magnolia grandiflora*, 3 options with mineral fertilizers in various combinations were tested. No fertilization was applied in the control. The scheme of experimental options (doses, timing and ratio of mineral fertilizers) is given in Table 1.

| Variants   | Carbamide (urea) N-46% | Ammophos P-48%,N-12% | Potassium, K-44% |
|------------|------------------------|-----------------------|------------------|
|            | During the appearance of 2-3 leaves | At the beginning of linear growth | During the period of increased growth | During the appearance of 2-3 leaves | At the beginning of linear growth | During the period of increased growth | During the appearance of 2-3 leaves |
| Control (used) | - | - | - | - | - | - | - |
| N30P30      | 30 | - | - | 30 | - | - | - |
| N60P30      | 30 | 30 | - | 30 | - | - | - |
| N90P60      | 30 | 30 | 30 | 30 | 30 | - | 30 |
| N120P90K60  | 60 | 30 | 30 | 30 | 30 | 30 | 60 |

The calculation of the fertilizer application rate was carried out according to the formula:

\[ X = \frac{ac}{100} \times b \]

Where:
- \( X \) – amount of fertilizers per plot, kilograms;
- \( a \) – dose of nutrient, kg / ha;
- \( b \) – nutrient in fertilizer, %; \( c \) – plot area, m².
Figure 1. Planting seedlings of tulip tree, paulownia and magnolia on a pilot site with mineral fertilizer: 1-Control (second-hand), 2- N30P30, 3- N60P30, 4-N90P60K30

Each fertilization option was laid in three replicates over three ridges. The length of the ridge is 10 m, in each ridge there are 10 seedlings and saplings, 20 in total. Each counting ridge was watered from 2 sides along the furrows. At the end of the growing season, the height and diameter of the root collar were measured for seedlings and seedlings, and their safety was determined. In model seedlings and saplings, the nature of the development of the root system, its fibrousness was studied, the air-dry mass of leaves, stems, roots and the whole plant was determined. Digital materials were processed by the method of variation statistics. When assessing the effectiveness of the use of mineral fertilizers, the yield of standard and varietal seedlings for each option was taken into account in comparison with the control (by state standard at 24909-81 “Ornamental deciduous tree seedlings”).

On the study of the irrigation regime of tulip tree seedlings according to the following scheme (Table 2). Each option according to the irrigation regime was laid in three replicates according to the scheme 2x1 m. In each replication there were 3 beds of 10 m in length, in each bed 10 pieces of seedlings, 30 pieces in total. Each registration bed was watered from both sides along furrows.

| Variants number | Pre-irrigation soil moisture, %PSM | Calculated soil layer for determining the irrigation rate, cm |
|-----------------|-----------------------------------|----------------------------------------------------------|
| 1               | Production (control)              | 0-75                                                     |
| 2               | 50-60                             | 0-75                                                     |
| 3               | 60-70                             | 0-75                                                     |
| 4               | 70-80                             | 0-75                                                     |

The calculated irrigation rates for all variants during the growing season were determined by the moisture deficit in the soil in layers of 0-25, 25-50 and 0-75 cm. every 10-12 days. According to the results of these observations, the timing and rates of irrigation were determined.

The timing of irrigation was set with a decrease in soil moisture in the calculated layers to the specified (50-60%, 60-70%, 70-80% of the PSM ), and on control by the external signs of plants. The irrigation rate in each case was calculated based on the moisture deficit in the 0-75 cm layer according to the formula of A.N. Kostyakov:

\[ M = 100 \text{ HA} (R-B) \text{ SF}; \]

Where: M – irrigation rate for one irrigation, cbm / ha;

- H – depth of the moistened soil layer, cm;
- A – bulk soil mass, g / cm³
- R – the smallest moisture capacity,%
- B – soil moisture before irrigation,%

SF – safety factor, taking into account the loss of water for filtration and evaporation during irrigation, the value SF + 1,1-1,2.
At the end of the growing season, the height and diameter of the root collar of seedlings and seedlings were measured, and their safety was determined. In model plants, the nature of the development of the root system, its fibrousness was studied, the air-dry mass of leaves, stems, roots and the whole plant was determined.

All the data obtained were processed by the methods of variation statistics. Criteria for the significance of the difference between the variants of the experiment in terms of the average height of seedlings and seedlings were also determined.

2.1. Soil and climatic conditions in the places of the experiment

The experiment in growing planting material of a tulip tree was laid on the territory of the experimental farm "Darkhan", which refers to the Tashkent district of the Tashkent region (there is a cooperation agreement No. 15 dated March 20, 2018). The soil is typical gray soil. Soil-agrochemical characteristics of typical sierozem soils, the place where the experiment was laid are given in Table 1 (Magnolia – small deciduous tree, up to 8 m high, leaves 17-20 cm long, obovate, pointed above, dark green above, glabrous, glaucous below).

### Table 3. Average annual air temperature (°C) and precipitation (mm)

| Years | Months | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|-------|--------|---|----|-----|----|---|----|-----|------|----|----|----|------|
|       | Temperature | -1.6 | -5.6 | 6.8 | 14.5 | 26.8 | 27.5 | 27.3 | 26.8 | 19.9 | 16.8 | 6.7 | -5.6 |
| 2017  |        | 2018  | -2.3 | -1.2 | 7.7 | 16.2 | 21.8 | 26.6 | 27.5 | 26.9 | 18.8 |    |     |
| 2019  | +0.7   | 2019  | +2.3 | +10.6 | +16. | +22. | +26. | +29. | +26. | +21. | -   | -   | -   |
|       |        |       | 1   | 2   | 3   | 3   | 4   | 6   |      |      |     |     |     |
|       | Precipitation | 32.1 | 32.2 | 64.2 | 10.4 | 25.5 | 13.4 | 8.5  | 5.0  | 13.5 | 19.8 | 32.2 | 27.8 |
| 2017  |        | 2018  | 27.4 | 33.5 | 68.4 | 14.2 | 20.6 | 11.5 | 2.6  | 1.0  | 3.0  |    |     |
| 2019  | 28.5   | 2019  | 31.2 | 66.1 | 13.6 | 23.5 | 12.4 | 2.2  | 0.8  | 8.3  | -   | -   | -   |

The flowers are thick-shaped, 10-15 cm in diameter, creamy white. Flowers are very fragrant, blooms in April-May, simultaneously with the appearance of leaves. Magnolia is very decorative and is a valuable material for park construction in areas with a warm and partly with a moderately cold climate. Magnolia requires rich, moderately moist, well-drained soil. Propagation by seeds, sown shortly after ripening by layering, green cuttings with a heel under glass and habituation on seedling rootstocks of different types.

Experimental work was carried out in the Pakhtaabad district of the Andijan region in the farm named after Saidullo Temirov. Pakhtaabad region is located in a zone of sharply continental climate. It is
characterized by dry soil and air, high summer temperatures, low relative humidity, abrupt changes in temperature and barometric pressure. This is confirmed by the data of the Andijan meteorological station, located 15 km from the site of the experimental sites. Table 3 shows the average annual air temperature and precipitation at the location.

3. **Results and Discussion**

The experiments were carried out on non-saline light gray soils. The main parent rocks are loess-like alluvial deposits. The mechanical composition is very diverse: heavy, medium loamy. Soils contain little humus (1.0-1.3%), negligible amount of total nitrogen (0.09-0.11%) and total phosphorus (0.14-0.16%). The reaction of the soil environment within the neutral – pH=7.0. Below is a genetic and morphological description of the soil section.

**A (0-25 cm)** Light gray, uniformly colored, lumpy-silty, loose medium loamy, dry, from HCl boils weakly, is medium penetrated by weed roots, pores of shrews are found.

**A1(25-58 cm)** Light gray, lumpy, highly compacted, light loamy, fresh, from HCl boils violently, weakly penetrated by plant roots, there are massive accumulations of carbonates, the transition to the next horizon is gradual.

**B1(58-90 cm)** Light gray, structureless, dense, fresh, noticeable accumulation of white-eyed, boils violently from HCl, the transition to the next horizon is clear.

**B2(90-120 cm)** Dark gray, structureless, slightly compacted, moist, boils violently from HCl, plant roots in the upper part are single small, (to the bottom there is none at all), the transition is gradual.

**C1(120-160 cm)** Light gray, loose, light loamy, no plant roots, from HCl below 130 cm does not boil, inclusions, neoplasms and excretions are absent.

A characteristic feature of the morphology of light gray soil is a sharply increasing density in the A1 horizons, the presence of a dense B1 carbonate horizon and a weak differentiation of the horizons. The texture of the soil is light and medium loamy. The results of the analysis indicate a great evenness of the texture within a meter layer (Table 4).

**Table 4. Mechanical composition of non-saline light gray soils of Pakhtaabad district of Andijan region**

| Horizon depth, cm | Fraction sizes in mm |
|-------------------|----------------------|
|                   | 1-0.25 | 0.25-0.05 | 0.05-0.01 | <0.01 |
| 0-25              | 0.12   | 15.3     | 47.92     | 35.9  |
| 25-58             | 0.11   | 19.1     | 42.6      | 38.4  |
| 58-90             | 0.10   | 17.1     | 43.6      | 40.0  |
| 90-120            | 0.05   | 18.5     | 39.2      | 42.5  |

The reaction of the soil environment is neutral – pH=7.4-7.7. The soils of the experimental plot contain a small percentage of humus: in the arable horizon up to 1.20% and in the lower horizons (C) before 0.007-0.015% (Table 5).

**Table 5. Agrochemical characteristics of the soil of the experimental site located in the Pakhtaabadd district of the Andijan region**

| Horizon depth, cm | pH water extract | Humus, % | Total nitrogen, % | Total phosphorus, % | Total potassium, % | mg / kg soil N-NO₃ | P₂O₅ |
|-------------------|------------------|----------|-------------------|---------------------|-------------------|---------------------|------|
| 0-25              | 7.5              | 1.20     | 0.026             | 0.197               | 0.73              | 1.77                | 61.0 |
| 25-58             | 7.6              | 1.26     | 0.021             | 0.153               | 0.63              | 3.53                | 63.0 |
| 58-90             | 7.7              | 0.20     | 0.015             | 0.077               | 1.37              | 3.99                | 60.6 |
| 90-120            | 7.4              | 0.13     | 0.007             | 0.018               | 0.32              | -                   | -    |
A similar dependence is observed for the content of total nitrogen and phosphorus, i.e. the soils are very poor in organic matter. The content of available phosphoric acid (according to Machigin) in the arable horizon is characterized by a very small amount, up to 61.0 kg/ha of soil.

In addition, the soils are characterized by a high content of total potassium in the arable horizon up to 0.73%. The agrochemical characteristics of the light gray soils of the experimental area gives grounds to assume a high efficiency of nitrogen-phosphorus fertilizers and a very weak one - of potash fertilizers (Table 5).

3.1. Growing paulownia seedlings from root suckers
Experiments to study the effect of heteroauxin on the growth of root suckers Magnolia grandiflora were carried out in the Pakhtaabad district of the Andijan region in the farm named after Saidullo Temirova. 480 pcs were prepared. Root cuttings (offshoots) with a size of 12-15 cm and planted according to the scheme 60 × 30 cm. To accelerate rooting, heteroauxin at a concentration of 150, 200 and 250 mg / l were used. The cuttings were soaked in heteroauxin for 10-12 hours, and then planted in prepared ridges. Cuttings soaked in clean water served as a control.

An inventory of rooted cuttings, carried out at the end of the growing season, showed that the percentage of rooted plants by root cuttings is from 13.2 to 37.1%.

3.2. Determination of the rate and depth of sowing of magnolia seeds
Experiments on the intensive technology of growing magnolia planting material were carried out on the territory of the farm named after Saidullo Temirova of Pakhtaabad district of Andijan region in conditions of light gray soil. The data obtained for determining the sowing rate of magnolia seeds are shown in Table 6.

| №  | Sowing rate of seeds, On the 1 p.m. | Magnolia seeds germination, pcs | Seedling safety |
|----|-----------------------------------|---------------------------------|----------------|
|    | 05.05.2019 | 15.05.2019 | 20.05.2019 | 25.05.2019 | 30.05.2019 | 10.06.2019 | 15.06.2019 | Total | % 30.07.2019 | in % |
| 1  | 2 | 1 | 1 | - | 2 | 2 | 1 | 9 | 90 | 8 | 80 |
| 2  | 15 | - | 2 | 2 | - | 1 | 4 | 2 | 11 | 73 | 9 | 60 |
| 3  | 25 | 4 | 3 | 2 | 2 | 2 | 2 | 4 | 19 | 76 | 8 | 32 |

Table 6. Determination of the seeding rate of magnolia seeds

Table 7. Biometric indicators of annual magnolia seedlings depending on the seeding rate

| Sowing rates Pcs / 1 p.m. | H cm | % | t | P |
|--------------------------|------|---|---|---|
| Control (Sowing in production 15 pcs / p.m.) | 8,1 | 100 | 1,8 | 2,7 |
| 10 | 3,5 | 100 | 1,1 | 1,8 |
| 4,0 | 114,2 | 1,3 | 2,2 |
| 20 | 7,4 | 91,3 | 1,7 | 3,1 |
| 3,0 | 85,7 | 0,9 | 1,9 |
| 25 | 6,0 | 74,0 | 1,5 | 2,8 |
| 3,0 | 85,7 | 0,8 | 2,2 |
From the data shown in Table 6, it can be seen that when sowing seeds 10 pcs per 1 running meter, seed germination rate was 90%, and at a rate of 15 pieces - 73%, and at a rate of 25 pcs. - 76%. Biometric indicators of annual magnolia seedlings, depending on the seed sowing rate, are given in Table 7.

From the data given in Table 7, it can be seen that the best increase was 10 pieces per 1 p.m., where the increase in height was 11.1%, in diameter 14.2%. The rest of the options for the seeding rate in comparison with the production option did not give a positive result.

The data obtained on determining the depth of sowing of magnolia seeds (Table 8) showed that at a depth of 3 cm in the control variant, where the sowing was carried out without treatment, the germination rate was 40%, in the variant where the sowing was carried out with rotted manure, the germination rate was 36%, in the variant, where the seeds were treated with root, the germination rate was 60%, and when sowing was performed rotted manure + root, the germination rate was 43%. Sowing seeds at a depth of 5 cm on the control variant, the germination rate was 28%, at the same depth where the sowing was carried out, with rotted manure, the germination rate was 20%, and where the seeds were processed, the germination rate with the root was 48%, and when the sowing was carried out, rotted manure + root root germination rate was 38%. And at a seed sowing depth of 10 cm, seed germination decreased and amounted to 20%, 0%, 30% and 24%, respectively. Table 9 highlights the biometric indicators of annual magnolia seedlings depending on the depth of sowing seeds.

3.3. Influence of mineral fertilizers and gibberellin on the growth of 3-year-old magnolia seedlings

Observations of 3-year-old magnolia seedlings were continued, depending on the different terms and doses of mineral fertilizers, the biometric indicators of which are given. For comparison, last year's biometric indicators of two-year-old magnolia seedlings under the influence of mineral...
fertilizers are given.

**Table 10.** Growth of 2- and 3-year-old magnolia seedlings, depending on the application of mineral fertilizers

| Variants          | Growth indicators |
|-------------------|-------------------|
|                   | х±Sx | H cm | V%  | Sx% | Lim | Growth in % |
|                   | Biennial |       |     |     |     |            |
| Control, (used)   | 39.1±2.1 | 17.49 | 2.163 | 33.47 | 100  |
|                   | 8.8±0.2 | 8.9 | 2.8 | 8.9 | 100 |
| N60P30            | 50.1±2.7 | 17.46 | 2.767 | 42.60 | 128.1 |
|                   | 9.8±0.2 | 9.3 | 2.9 | 9.0 | 111.3 |
| N90P60            | 63.3±1.4 | 7.18 | 1.438 | 60.70 | 161.9 |
|                   | 9.9±0.3 | 9.9 | 3.1 | 9.13 | 112.5 |
| N120P90K60        | 70.3±2.0 | 9.24 | 2.055 | 60.80 | 179.8 |
|                   | 11.9±0.4 | 12.1 | 3.5 | 12.14 | 135.2 |
|                   | Three-year |       |     |     |     |            |
| Control, (used)   | 49.3±5.28 | 36.8 | 116.6 | 100  | 100  |
|                   | 10.2±0.332 | 10.2 | 3.2 | 100 |
| N60P30            | 64.1±2.84 | 16.6 | 5.25 | 130.0 | 108.3 |
|                   | 11.05±0.270 | 8.057 | 2.54 | 145.4 |
| N90P60            | 71.7±3.6 | 18.8 | 4.77 | 124.0 |
|                   | 12.65±1.25 | 8.057 | 3.15 | 124.0 |
| N120P90K60        | 89.9±4.36 | 17.67 | 4.87 | 182.3 |
|                   | 17.2±0.98 | 5.59 | 168.2 |

**Figure 3.** General view of the experimental site for growing magnolia

From the data given in Table 10, it can be seen that in the option N120P90K60 the growth of seedlings in height was 182.3%, diameter – 168.2% against the control option taken for 100%. The variant with the introduction of N90P60, where the increase in height was 145.4%, in diameter 124.0%.
We studied the effect of the stimulant gibberellin on the growth and survival rate of 3-year-old magnolia seedlings. Experienced seedlings were sprayed in two stages at a concentration of 150, 200 and 250 mg/l during the appearance of 2-3 leaves (25.04.) And 20-25 days before the growth of seedlings in height (Table 11). On the control plants were sprayed with water.

From the given Table 12 it can be seen that gibberellin treatment of 2-year-old magnolia seedlings has a positive effect on their growth. For example, in the 250 mg/l variant, the growth of seedlings in height was 145.7 cm, diameter - 16.8 mm, and in the 200 mg/l variant, 128.1 cm and 14.7 mm versus the control variant 96.25 cm and 9.75 mm respectively.

Table 11. Biometric indicators of 3-year-old seedlings magnolia depending on gibberellin treatment

| № | Options                     | Height, cm (x±Sx) | V% | Diameter, mm (Sx%) | Lim | Growth,% |
|---|-----------------------------|-------------------|----|-------------------|-----|----------|
|   | Biennial                    |                   |    |                   |     |          |
| 1 | Control, without arr.       | 39.4±1.0          | 7.6 | 2.4               | 35-44 | 100     |
|   |                             | 8.8±1.5           | 0.2 | 7.4               | 8-9  | 100     |
| 2 | 150 mg / l                 | 50.2±1.4          | 6.5 | 2.9               | 44-60 | 127.4   |
|   |                             | 9.8±1.8           | 0.2 | 8.3               | 9-10 | 111.3   |
| 3 | 200 mg / l                 | 61.5±1.4          | 10.3 | 1.3             | 60-70 | 156.1   |
|   |                             | 10.9±2.6          | 0.3 | 9.9               | 10-12 | 123.8   |
| 4 | 250 mg / l                 | 68.5±4.1          | 9.6 | 3.0               | 70-114 | 173.8   |
|   |                             | 11.9±1.9          | 0.4 | 11.3              | 12-14 | 135.2   |
|   | Three-year                  |                   |    |                   |     |          |
| 1 | Control, without arr.       | 96.25±1.87        | 6.18 | 1.91             | 85-110 | 100     |
|   |                             | 9.75±0.25         | 8.35 | 2.64             | 8-11  | 100     |
| 2 | 150 mg / l                 | 124.0±1.53        | 3.93 | 1.24             | 110-135 | 128.9   |
|   |                             | 12.6±0.28         | 7.36 | 2.32             | 10-15 | 129.8   |
| 3 | 200 mg / l                 | 128.1±2.58        | 6.33 | 2.03             | 110-140 | 133.1   |
|   |                             | 14.75±0.38        | 7.37 | 2.33             | 15-19 | 133.2   |
| 4 | 250 mg / l                 | 145.7±6.5         | 14.5 | 4.58             | 130-170 | 151.4   |
|   |                             | 16.8±0.50         | 7.06 | 2.23             | 18-19 | 173.2   |

4. Conclusions

1. The use of intensive agricultural technology (fertilization, irrigation regime, growth stimulants) when growing planting Magnolia grandiflora significantly improves the nutritional and water regime of plants, has a great impact on increasing the growth of seedlings and seedlings, as well as their output per hectare.

2. The most optimal sowing depth of magnolia seeds is 3 cm, where the germination rate was 90%, and the sowing rate was 10 pcs/rm, where the increase in height was 11.1%, the diameter was 14.2% to the control.

3. Mineral fertilizers have a positive effect on the growth of 3-year-old magnolia seedlings. The best growth was shown by the option N90P60 and N120P90K60, where the average growth was 45.4-82.3% in height, 24.0-68.2% by diameter.

4. Treatment with gibberellin of 3-year-old magnolia seedlings has a positive effect on their growth. The best result was shown by treatment with gibberellin at a concentration of 200 and 250 mg / l, where the growth of seedlings in height was 33.1-51.4%, diameter - 33.2-72.2%.

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