

AGRICULTURAL SCIENCES

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Executive Board for protected areas of regional significance in the Udmurt Republic

GARDEN NON-PROFIT PARTNERSHIPS (SNT) AND BIODIVERSITY

Garden non-profit partnerships (SNT) hardly ever been studied scientifically. In land use statistics, this is also the weakest link. The article delivers studied standard units (landscape areas about 6 hectares) in the Yelabuga city suburbs and within the city itself, SNT included. Floristically, they are the closest to the private sector. Despite the introduced species planted, SNTs are poorer in biodiversity compared to many of those urban standard units and partial floras. This is explained by a strong human selective influence. Before to quit an SNT and to develop its territory, the most valuable tree-and-shrub species and varieties should be replanted to their new bedplaces with their earth lump preserved. The translocation will serve to conservation of the urban flora biodiversity.

Key words: garden non-profit partnerships (SNT); SNT statistics; biodiversity; translocation.

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BIOECOLOGICAL FEATURES OF THE GENUS *HYDRANGEA* L.' REPRESENTATIVES IN THE CONDITIONS OF THE CITY OF IZHEVSK

Rising volumes of creating new and reconstructing currently actual recreation areas for the citizens' leisure entails the demand growth for ornamental trees and shrubs. Therefore, the study of biological features of the genus *Hydrangea* L.' species and varieties is quite relevant. In this regard, the purpose of the work is to characterize varying degrees of adaptability to unfavorable abiotic and biotic environmental factors of 14 species and varieties of *Hydrangea* from the collection of the Department of Plant Introduction and Acclimatization, and to determine the prospects of using these taxa in the landscaping of cities in the Middle Urals. For the assessment based on ornamental characteristics, a technique was used, developed by the staff of the botanical garden in Ufa. Methodological developments on decorativeness of various cultures are taken as a basis. The characteristics of meteorological conditions during the years of research (2019–2020) are given. According to the research results, 7 representatives of the genus *Hydrangea* were noted as the most promising candidates for green constructing in the cities of the Middle Urals: panicle hydrangea *Hydrangea paniculata* Ziebold – 'Lime-light', 'Pinky Winky', 'Wim's Red' and 'Vanille Fraise'; serrata hydrangea *Hydrangea macrophylla*

ssp. *Serrata* (Thunb.) Makino – ‘Bluebird’ petiole hydrangea *Hydrangea petiolaris* Siebold & Zuss. cultivar ‘Petiolaris’ and hydrangea arboreal *Hydrangea arborescens* L. cultivar ‘Annabelle’. According to the results of two years of observation (2019–2020), these taxa had a decorativeness rating of 50 to 73 points and were assigned to the II group of decorativeness, winter hardiness (5 points). It was noted that unfavorable climatic conditions (moisture deficit, cool May and June 2020) reduced the average decorativeness score of the entire collection of representatives of the *Hydrangea* genus by 10 points, caused the decrease in the flowering quality indicator.

Key words: hydrangea; collection; features of growth; landscaping; floriculture; decorativeness.

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FEATURES OF THE TEMPERATURE RANGE WITH DIFFERENT METHODS OF PLACING GRAPES (*VITIS VINIFERA* L.) UNDER THE CONDITIONS OF THE MIDDLE AFORE-URALS IN SUMMER PERIOD

One of the problems in grape farming in the conditions of the Middle Afore-Urals is insufficiency in the totality of active temperatures (TAT), and non-favorable temperature conditions at discrete periods of the growing season. The aim of the research was to study the temperature regime of the air and soil during the growing season thus dependent on the methods of grape plantings' placement. The experiment was laid on the territory of the botanical garden of UdSU, 2011. The grape bushes were planted as per the scheme 2.0 × 1.5 m, in trenches (control), on a flat surface and grape beds. The tallies and observations were carried out in 2019. The temperature was measured 8 times a day with electronic thermometers TP-1: on the lower wire of the trellis, 50 cm above the soil surface and in the soil, at a depth of 10 cm at a distance of 20 cm from the base of the bush. The sum of active (10 °C) air temperatures over the vineyard in 2019 was 2033.5 °C, which meets the requirements for early-ripening grape varieties. The method of distribution the grape plantings had a significant impact on the TAT of the soil: the temperature on the bed was 2141.7 °C, on a flat surface and in the trench 2094.5 °C and 2090.2 °C, respectively. Thus, the best option for placing grape bushes on a flat surface and on the bed had been proved. With this planting, the vines receive more heat, which contributes to their better growth and development.

Key words: grapes; heat supply; totality of active temperatures; flat surface; vine bed; trench.

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GARDENING IN UDMURT REPUBLIC

Gardening is one of the most important branches of agriculture. Its main function is to provide population with fresh high-vitamin products. The purpose of the study was to analyze the state and assess the prospects for the development of gardening in the Udmurt Republic. In the course of fulfilling the set goals and objectives, a systematic approach was applied as well as methods of comparison, systematization and analysis of data were used. The principal sources of information there served the works of national scientists and abroad, those of in the field of gardening, also data from the Federal State Statistics Service, and legal and regulatory framework. The article presents the results of the study of the current state of the horticulture industry in the Russian Federation and the Udmurt Republic. The dynamics of the areas of fruit and berry plantations, the structure of the gross harvest yield were analyzed. It is shown that currently the production of fruit and berries lies mainly on the of the population's households where this indicator is 64.2 % in Russia, and 95.0 % in Udmurtia. In most subjects of the Russian Federation there is a shortage of fruit and berry products that directly depends on the economic and geographical location, and in each region it is different. According to the recommendations on the rational consumption of fruits and berries, the norm per person per year is 90–100 kg. In the Udmurt Republic in recent years, the consumption of this biologically valuable type of products amounted to 57 kg. The analysis allows us to conclude that in order to implement the serious tasks of the Food Security Doctrine in the Russian Federation, there is an opportunity in every region, including the Udmurt Republic, to make a certain contribution to solving the existing problem, and for this there is a need to update the gardening system, search for priority areas of improvement of innovation and investment activities in this industry.

Key words: gardening; perennial plantings; garden area; gross harvest; consumption of fruit and berries.

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CLONAL MICRO DISSEMINATION OF BERRY CROPS

The aim of the research is to optimize the conditions for in vitro cultivation of blue honeysuckle and raspberry. The work was carried out in 2016–2019. The Murasige-Skuga medium ($\frac{1}{2}$ MS) was the control medium for the initiation of explants of all cultures. Additionally, the following media were used: for honeysuckle – $\frac{1}{2}$ MS modified with a reduced NH_4^+ content by 15 % compared to the base MS, Woodi Plant Medium ($\frac{1}{2}$ WPM); for raspberries – Quoirin-Lepoivre ($\frac{1}{2}$ QL) and $\frac{1}{2}$ Anderson medium. The action of LED phytoirradiators (LED-irradiator) with a combination of red, blue and white light in the spectrum 2:1:1, 1:1:1, 2:1, respectively, LED-irradiators with a changing spectrum and flashing was studied at the stages of microspreading and rooting. The survival rate of honeysuckle explants on $\frac{1}{2}$ WPM medium was 62.2 % (27.9 % control). The highest multiplication factor of 5.1 (2.6 control) was obtained using an LED illuminator 2 red : 1 blue : 1 white on the medium MS modified + 6-BAP 1.0 mg/L + kinetin 0.5 mg/L. High rooting rate of honeysuckle of 89.0 % (76.0 % control) was obtained on the medium MS modified + IBA 0.5 mg/L. Cultivation of red raspberries on medium QL + 6-BAP 1.0 mg/L + GA 0.5 mg/L and irradiation with a LED irradiator 2 red : 1 blue : 1 white led to a multiplication factor of 5.3 (2.7 control). An addition, into QL medium an IMA 0.5 mg/L + HB-101 100 $\mu\text{l/L}$ and irradiation with a LED irradiator 1 red : 1 blue : 1 white ensured 100 % rooting. Introducing into QL medium a 6-BAP 1.0 mg/L + IBA 0.2 mg/L + GA 0.5 mg/L and illumination with an LED-irradiator 1 red : 1 blue : 1 white have increased the multiplication factor of remontant raspberries by 1.6 times (from 2.6 to 4.1), and the use of QL + IBA 0.5 mg/L + HB-101 50 $\mu\text{l/L}$ medium and LED-irradiation 2 red : 1 blue : 1 white have increased its rooting rate to 96 % (67 % control).

Key words: honeysuckle blue (*Lonicera caerulea*); common raspberry (*Rubus idaeus*); clonal microspreading; LED phytoirradiator.

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VACCINATION USAGE TO PRESERVE BIODIVERSITY OF PINE IN RUSSIA

Pine is an important forestry and ornamental tree. For the widespread introduction of species, garden forms and varieties into practice of green building, the study of the methods of their vegetative reproduction, which allows you to preserve all their valuable characteristics and properties, is of particular importance. At the same time, the speed of reproduction and cultivation of these plants depends on the methods and efficiency of their reproduction. Often, representatives of the genus *Pinus* introduced in other regions lack seed production. Therefore, it is possible to obtain planting material only by vegetative means. Due to poor rooting of cuttings of most pine species, the main and one of the most effective methods of vegetative propagation is grafting. At present, the collection of pines of the Sochi Arboretum is decreasing. The reasons are the age of the plants and the deterioration of growing conditions. Reproduction by seed is complicated due to their absence, so an experiment was carried out on reproduction by a vegetative method. Thus, the purpose of the research was to study the fundamental principles of the use of grafting in the genus *Pinus* for the introduction and preservation of biodiversity in the conditions of Udmurtia and Sochi. It had been revealed that when grafting pine species, *Pinus nigra*, *Pinus peuce* showed good compatibility with Scots pine under the conditions of Udmurtia. *Pinus mugo* var. *pumilio* and *Pinus banksiana*. A successful result in Sochi was obtained in 8 variants (scion-rootstock): *Pinus sabiniana* – *Pinus sylvestris*; *Pinus parviflora* cv. *Glauca* – *Pinus parviflora*; *Pinus parviflora* cv. *Glauca* – *Pinus koraiensis*; *Pinus* × *hunnewellii* – *Pinus koraiensis*; *Pinus* × *hunnewellii* – *Pinus elliottii*; *Pinus* × *schwerinii* – *Pinus elliottii*; *Pinus sylvestris* cv. *Fastigiata* – *Pinus tabuliformis*; *Pinus gerardiana* – *Pinus thunbergii*.

Key words: pines; biodiversity; national collection; introduction; method of generic complexes; grafting; scion-rootstock combination.

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**TEA-HYBRID ROSES IN THE COLLECTION OF INTRODUCTION
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A rose, as an ornamental plant, is an ancient culture, and has medicinal and economic significance. Garden varieties of roses are whimsical to environmental conditions and can not grow successfully in all regions, while being of great importance in the landscaping of populated areas. Therefore, when introducing garden roses, there is a need for their comprehensive study in order to identify rose varieties that are promising to have been adapted to the conditions of the region. The introductory study of tea-hybrid roses' varieties was carried out for the collection of the Department of Plant Introduction and Acclimatization of the UdmFIC Ural Branch of the Russian Academy of Sciences. The collection of root-related roses was founded in 2018; the group of tea-hybrid varieties under investigation has 4 names. Phenological observations, assessment of resistance to diseases and pests were carried out. the prospects of the varieties were evaluated in respect of their complex of decorative qualities, According to the duration of flowering, Angelique and Troika varieties can be distinguished (127 days). In total, 2 pathogens were detected on roses during the growing season. The greatest disease damage was observed in the Prestige, Angelique varieties (4–5 points of impact), and the lowest degree of damage was noted in the France Info variety, by 1 point. To assess the decorative effect, it is proposed to use 7 features, and to assess the prospects of using rose varieties, the following features should be considered: resistance to diseases and pests and total decorative effect.

According to the totality of assessment, the most decorative varieties are the varieties Troika, Angelique, being referred to class 1 potentials recommended for introducing into decorative gardening with non-restrictions in traditional cultivation technology.

Key words: rose; tea-hybrid group; varieties; phenology; phases of development; diseases; perspectives.

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TECHNICAL SCIENCES

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ESTIMATION OF THE EFFICIENCY OF LED RGB PHYTO IRRADIATION PLANTS IN CULTIVATION OF MICROCLONAL PLANTS

The aim of our research was to evaluate the effectiveness of RGB LED phytoradiators when growing microclonal plants of honeysuckle and grapes. We carried out tests on the basis of the microclonal laboratory of the UdmFIC UB RAS on microclonal cultures of honeysuckle “Delight” and grapes “RF 48”. Plants were grown at a temperature of $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 30 days – for the stages of accumulation of leaf area and root growth, and at the stage of adaptation – 25 days. The main criterion for efficiency was the indicator of the area of green leaves. Measurements were taken every 5 days. The leaf area of each microclonal plant in a test tube was measured in two projections with three replicates. Using the data obtained, mathematical relationships were constructed that describe the increase in leaf area. The obtained mathematical relationships allowed us to develop mathematical models that show the growth rate of green mass of plants, depending on the influence of various spectra of the developed phyto-irradiation installations, at each stage when growing grapes and honeysuckle. The criterion for the effectiveness of irradiation of meristem plants is the maximum increase in the green mass of plants. FOU 1_{otracr} turned out to be the most effective at all stages of growing grapes “RF 48” and honeysuckle “Delight”, except for the stage of planting grapes “RF 48” in the ground, where FOU 2_{uf} turned out to be the most effective. To assess the effectiveness of RGB LED phyto-irradiation installations, we improved the formula for the exergy of radiation by I. I. Sventitsky, taking into account the spectral transmittance of monochromatic radiation, since the plants are in glass test tubes. Which allows you to determine the cost-effective energy, measured in $\text{W} / (\text{mm}^2 \times \text{ruble})$. Analysis of the calculation of cost-effective energy when growing grapes “RF 48” shows that at the stages of root growth and accumulation of leaf area, FOU 1_{otracr} has the greatest useful active energy, and at the stage of planting in the ground, FOU 2_{uf} has the greatest useful active energy. When growing honeysuckle “Delight” at all three stages of FOU 1_{otracr} has the greatest useful active energy.

Key words: microclonal plants; phyto-irradiation installations; exergy; photosynthetically active radiation; LEDs; cost effective energy.

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INVESTIGATION OF THE PARAMETERS OF A WET DUST COLLECTOR FOR GRAIN CRUSHERS

The article is devoted to the study of an experimental installation for the separation of dust from the pneumatic system of hammer crushers of grain. The most common devices for capturing dust are cyclones, which are widely used for dry air purification from all types of dust. In grain crushers, along with cyclones, fabric filters are used to capture dust. The efficiency of air purification in bag fabric dust collectors mainly depends on the properties of the filter cloth. The existing dust collectors do not fully meet the requirements for air purification from dust due to their insufficiently high efficiency. Therefore, improving the efficiency of existing and new, more efficient devices for separating or trapping dust is an urgent task.

For conducting research, an experimental installation was made containing.. Experimental studies of the dust collector operation process were carried out using the methods of a one-factor experiment.

As a result of the conducted studies, it was established: the obtained approximation equations with sufficient reliability allow us to solve a number of engineering problems when designing dust collectors for specific crushers; the maximum minimum rotation speed is 7.5 s^{-1} (447 rpm), which corresponds to the dust concentration in the dust collector liquid – 36.8 %; the liquid level in the dust collector increases linearly with an increase in the dust concentration in it; the height of the blades determined by the approximation equations for the maximum dust concentration of 36.8 % should be at least 0.002 m; based on laboratory studies, when designing a dust collector for a KDM type crusher with a diameter of the stirrer blades equal to the diameter of the air duct of 0.15 m, the minimum speed of rotation of the blades should not be lower than 4.15 s^{-1} .

Key words: dust collector; grain crushers; efficiency; fan; agitator; pressure; liquid density; model.

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MECHANISM OF ADAPTABILITY OF CERAMIC COUPLINGS BASED ON BORON CARBIDE UNDER HIGH FRICTION RATES

High thermal stability and chemical neutrality of ceramic structures provide the feasibility of their operation in bearing interfaces at high temperatures and kinematic modes. There is no full-bearing information on the stability of tribological properties and of mechanisms of adaptation of ceramic interfaces under conditions of high rates and temperatures. In the article, we have delivered the investigation of the state of the tribological characteristics of thin ceramic coatings based on boron carbide under conditions of high friction rates and temperatures. To achieve the goal, a technique has been developed for conducting tribological studies under conditions of high friction rates, dynamic loading and the absence of intensive lubrication. An analysis of the formation of a tribofilm under above conditions of high friction rates had been done based on the dynamics of changes in the coefficient of friction.

As a result of tribological studies, the opposite dynamics of the change in the friction coefficient in the ceramic interface at speeds of 6 m/s in comparison with the standard interface based on a hardened steel surface was revealed. For ceramic coatings, an abrupt decrease in the friction coefficient is observed with the release of a large amount of heat. The released energy synthesizes in the contact zone a stable tribofilm based on the boric acid, which provides a significant decrease in the coefficient of friction. Tribofilm formation occurs only at temperatures above 250 °C, the latter is achieved due to a high friction rate and dynamic loading. The results obtained confirm our assumptions about the feasibility of synthesizing tribofilms with a significant deviation from the recommended operating parameters. The research results are of high practical importance and can be used in the design of heavily loaded and high-speed bearing interfaces.

Key words: ceramic coating; coefficient of friction; boron carbide; high temperature; self-organization of the structure.

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