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KEY ASPECTS OF LAWN GRASSES USAGE IN LANDSCAPE RECLAIMING UNDER CLIMATE CHANGE

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The article examines the functions and distinctive attributes of turfgrass species. in landscape reclamation, particularly under the influence of rising temperatures, irregular precipitation, and increased weather extremes in the Podillya region. It shows that lawns are an essential component of landscape architecture and green construction. These lawns serve multiple purposes, including enhancing aesthetics, contributing to ecological balance, and providing recreational spaces. The study emphasizes the importance of understanding how climate change impacts the use and maintenance of lawn grasses to ensure their continued functionality and benefits in urban and rural landscapesThe Poaceae family, a significant group within the World Flora, consists of approximately 11,000 species, with 420 species commonly found in Ukraine. This family is notable for its adaptability and suitability in landscape reclamation efforts. The experimental field studies took place in Podillya Botanical Garden, which is part of the VNAU. The focus of the research was the botanical garden itself, situated on reclaimed land surrounding. The research focuses specifically on examination various grass species, including meadow fescue (Poa pratensis L.), red fescue (Festuca rubra L.), common ryegrass (Agrostis tenuis), creeping ryegrass (Agrostis stolonifera L.), perennial ryegrass, pasture and English ryegrass (Lolium perenne), as well as crested ryegrass (Agropyron cristatum L.). The evaluated species demonstrate remarkable growth and adaptability to the distinct environmental conditions of the botanical garden. They are highly versatile across a range of planting scenarios and under varying water and light regimes. These plants are well-suited for diverse applications, including group and solitary arrangements, flower beds, mixborders, borders, rockeries, and rocky gardens. Additionally, they are ideal for specialized landscaping projects such as Japanese gardens, mono-gardens, and other creative planting designs.

Their adaptability and aesthetic appeal make them excellent choices for enhancing both traditional and modern garden landscapes. Meadow fescue (Poa pratensis L.) has proven to be a highly adaptable and valuable grass species, demonstrating exceptional winter hardiness and resistance to trampling. This species offers significant ecological and economic benefits, including its decorative appeal, anti-erosion properties, and utility as fodder. In the second year of vegetation, lawn grasses demonstrated different rates of linear growth in height, which is due to their biological characteristics, nutritional conditions and ecological adaptability. Observations confirmed that during this period most species were stably restored after the winter period, gradually forming a dense grass cover. The most rapid rates of growth were reached in July, regardless of the species. Thus, red fescue grew up to 98 cm, common broomrape – up to 80 cm, comb ryegrass – up to 65 cm, meadow fescue – up to 61 cm, and creeping broomrape – up to 30 cm. In addition, data are provided on the economic efficiency of creating and maintaining lawns on the territory of the reclaimed landscape near the Temple of the Ecumenical Teachers and Saints. Consequently, it is mentioned that the overall expense of maintaining a lawn at 2025 prices will be 2,557 UAH per 100 m², while the costs of creating 100 m² reach 5,512 UAH.

Key words: *lawn, species composition, ecological sustainability, decorativeness, economic efficiency.*

Table 6., Fig. 3., Lit. 12.

Problem statement. Lawns are a basic element of landscape architecture and green construction, performing at the same time aesthetic, ecological and recreational functions. They form a harmonious background for architectural ensembles, administrative buildings, palace complexes and historical monuments, emphasizing their compositional significance. Due to the color contrast, lawns enhance the decorative effect of other elements of plantings – flower beds, hedges, ornamental trees and shrubs – creating complete, compositionally balanced spaces [1, 2]. As an integral part of any green construction object, lawns occupy a leading place in the structure of garden, park and urban spaces. They are not just a fragment of landscaping, but specially created and maintained ecosystems managed by man. The basis of these ecosystems is artificially formed plant communities with a predominance of mesophytic grasses, which, due to their biological properties, ensure the stability and durability of the grass cover [3]. Studies on the use of lawn grasses in landscape reclamation form a harmonious background for architectural ensembles, administrative buildings, palace complexes and historical monuments, emphasizing their compositional significance.

Analysis of recent research and publications. Among the herbaceous plants Ideal for landscape restoration revitalization and having excellent qualities under climate change, representatives of the *Poaceae* family are distinguished, which constitute a numerous (approximately 11,000 species, 420 of commonly found throughout Ukraine) group of the World Flora. The *Poaceae* family encompasses some of the most vital agricultural crops (wheat, rice, rye, etc.) that form food security [3]. The ecological function of cereals as components of phytocenoses and landscape spaces is no less important [4].

Grasslands are one of the most popular symbols of modern urban landscapes – lawn biotopes and ornamental grasses are increasingly used in landscaping. For optimal human living conditions in urban conglomerates of temperate climates around the world, green spaces should contain 3 main components: trees and shrubs (20-30%), flower beds (2-5%) and lawns (60-90%).

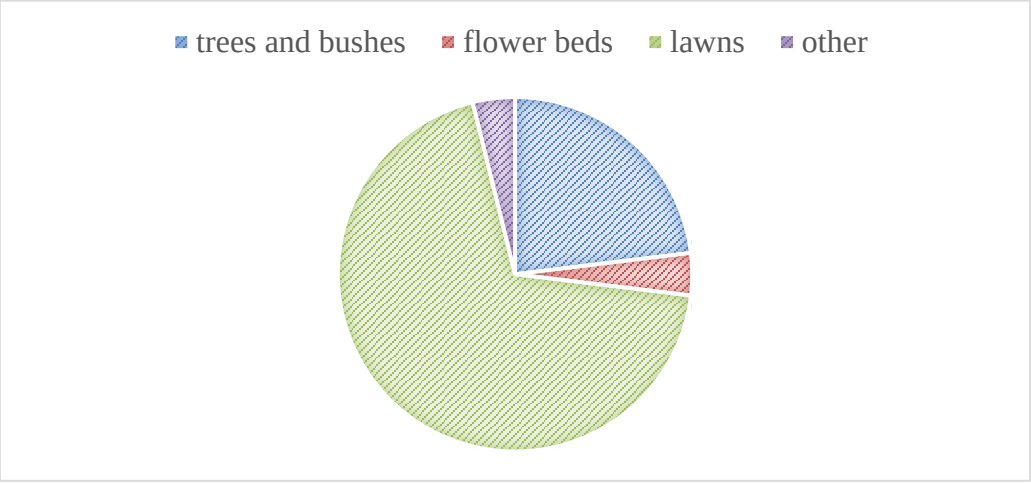

Fig. 1. Balance of landscaping elements to ensure a comfortable human environment in urbanized areas

Source: based on own research

The role of grasses in urban landscaping has become increasingly significant as cities strive to embrace sustainable and environmentally friendly design practices. Currently, lawns dominate urban green spaces, accounting for approximately 70-75% of all territories. There were many newly established lawns undergo transformations over time, evolving into meadow-like ecosystems or informal liminal spaces due to factors such as insufficient maintenance, heavy human activity, and changing environmental conditions.The global climate crisis and shifting microclimatic conditions in urban areas further exacerbate the challenges faced by lawn and ornamental grasses. These factors impact the health, diversity, and resilience of grasses, making it essential to reconsider their role in urban landscaping. Sustainable landscape design, commonly known as green design, focuses on incorporating resilient plant species and innovative adaptive strategies to foster thriving ecosystems in urban settings [1, 2, 5].

Research conditions. The research was conducted within the Botanical Garden "Podillia" of VNAU, located in Vinnytsia city, Vinnytsia region. Observations were carried out under field conditions to assess the growth and development of lawn grasses. The soil and climatic characteristics of this area are highly conducive to supporting the healthy establishment and sustainability of such vegetation(Fig. 2, Fig. 3).

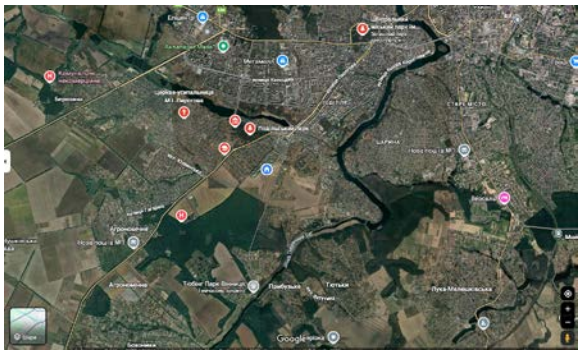

Fig. 2. Location plan of the Podillya Botanical Garden of VNAU, Vinnytsia

Fig. 3. Object of research: Botanical Garden «Podillia» of VNAU

Source: based on own research

Subject of research: meadow fescue (*Poa pratensis* L.), red fescue (*Festuca rubra* L.), common broomrape (*Agrostis tenuis*), creeping broomrape (*Agrostis stolonifera* L.), perennial ryegrass, pasture, English (*Lolium perenne*), crested wheatgrass (*Agropyron cristatum* L.).

Object of research: Botanical Garden «Podillia» of VNAU (territory of the reclaimed landscape) [6, 7].

Research results. Lawn grasses have high economic value, as they combine decorative, ecological and utilitarian properties, which determine their suitability for use in landscaping areas of various functional purposes [8-12]. The main criteria for their evaluation are durability, resistance to adverse conditions, decorativeness and environmental efficiency (Table 1).

Table 1

Economically valuable characteristics of lawn grasses

Type of plants	Type of lawn	Advantages	Direction of use
Poa pratensis L.	all	good winter hardiness, trampling resistance	highly decorative, anti-erosion, forage
Festuca rubra L.	parterre, racecourses, green areas	strong tillering, trampling ability	highly decorative
Agrostis tenuis L.	park lawn, green areas	resistant to mowing, trampling ability	decorative
Agrostis stolonifera L.	park lawn, green areas	mowing resistant	decorative
Lolium perenne L.	park lawn	mowing resistant	highly decorative, anti-erosion, forage
Agropyron cristatum L.	park lawn	mowing resistant	highly decorative, anti-erosion, forage

Source: based on own research

The most versatile was the meadow fescue (*Poa pratensis* L.), which, according to economic indicators, was winter-hardy and showed resistance to trampling. The plants have a highly decorative, anti-erosion and fodder value.

In the second year of vegetation, lawn grasses demonstrate different intensities of linear growth in height, which is due to their biological characteristics, nutritional conditions and ecological plasticity. Observations have shown that during this period, most species show stable recovery after wintering and gradual formation of a dense grass stand (Table 2). The tallest plants, regardless of the species, are in July. Thus, *Festuca rubra* L. reaches a height of 98 cm, *Agrostis capillaris* L. – 80 cm, *Agropyron cristatum* L. – 65, *Poa pratensis* L. – 61 cm, *Agrostis stolonifera* L. – 30 cm.

Grasses exhibit remarkable ecological plasticity, making them resilient and adaptable to a wide range of environmental conditions.

Table 2

Dynamics of linear plant growth in height of lawn grasses in the second year of life depending on the species, cm

Type of plants	The month of vegetation				
	march	april	may	june	july
Poa pratensis L.	0	12	15	33	61
Festuca rubra L.	0	18	22	45	98
Agrostis tenuis L.	0	15	19	38	80
Agrostis stolonifera L.	0	7	11	22	30
Lolium perenne L.	0	11	19	29	54
Agropyron cristatum L.	0	16	27	36	65

Source: based on own research

The studied species demonstrate exceptional tolerance to frost, drought, high humidity, and soil salinity, highlighting their suitability for diverse climates and terrains. These lawn grasses are versatile and can thrive in various planting styles and locations with differing water regimes and lighting conditions. Their adaptability allows them to be effectively used in group or solitary arrangements, enhancing the aesthetic appeal of flower beds, mixborders, borders, rockeries, and rocky gardens. Additionally, they are well-suited for specialized landscaping designs such as Japanese gardens, monogardens, and other ornamental plantings. This versatility underscores their value in both functional and decorative horticultural applications. [9].

Analysis of the data in Table 3 shows that a significant number of plants (82%) have the II category of plant vitality. The highest degree is possessed by the comb *Agropyron dertorum* Fisch. ex Link and *Festuca rubra* L.

Table 3

Vitality and decorativeness of lawn grass cenopopulations in the conditions of the VNAU park zone

Type of plants	The degree of vitality			Decorative assessment
	I	II	III	
Poa pratensis L.		+		4
Festuca rubra L.	+			4
Agrostis tenuis L.		+		3
Agrostis stolonifera L.		+		3
Lolium perenne L.			+	3
Agropyron cristatum L.	+			4

Source: based on own research

The discovery was made shows that meadow fescue and perennial ryegrass plants do not tolerate frequent mowing, red fescue has low compatibility with other species, broomrape develops quickly but is short-lived, and comb ryegrass is unstable in grass mixtures. Detailed characteristics of factors affecting the growth and development of several lawn types of grasses are given in Table 4.

Table 4

Ecological characteristics of the most used turf-forming species in the conditions of the park zone of VNAU

Type of plants	Soil requirements	Lighting requirements	Drought resistance	Life form
Poa pratensis L.	megatrophs	He (ScHe)	4	Sil
Festuca rubra L.	mesotrophs	ScHe	5	St
Agrostis tenuis L.	mesotrophs	ScHe	2	Pr
Agrostis stolonifera L.	mesotrophs	ScHe	2	Pr
Lolium perenne L.	mesotrophs	ScHe	5	Pr
Agropyron cristatum L.	megatrophs	He	3	Pr

Source: based on own research

Research indicates that the majority of lawn grasses are categorized as mesotrophs based on their soil nutrient needs. As for their life form, they are predominantly identified as meadow plants. Fescue species are distinguished by the highest of lawn plants traits that enable to withstand prolonged periods of water scarcity. The collected data allows for evaluating the condition and quality of grass plants within lawn groups and facilitates their selection while considering shared requirements suited to the respective ecological and conditions of a climate.

Table 5 presents data on the economic efficiency of creating and maintaining lawns within the research object: the territory of the reclaimed landscape around the Temple of the Ecumenical Teachers and Saints.

Table 5

Economic efficiency of creating and maintaining lawns for calculating replacement cost per 100 m^2

Indicator	Cost of creation	Maintenance cost
Labor (salary), UAH	2345	1003
Material, UAH	1610	-
Machines and mechanisms, UAH	878	656
General production, UAH	456	675
Administrative, UAH	223	223
Total direct costs, UAH	5512	2557

Source: based on own research

The functioning of the grass covering system, which includes all care measures, begins with the process of seed germination and the development of seedlings and continues during the entire lifespan of the lawn. Newly created grassy covers that vegetate for a year or two are especially demanding egarding adherence to the technological care framework. Considering these characteristics and the pricing strategy projected for 2025 the overall expense of maintaining the lawn cover is 2557 UAH per 100 m^2. To develop 100 m^2 of lawn cover, you need to spend 5512 UAH.

According to literary sources and already known scientific results the volume of CO_2 can be determined through calculations (carbon dioxide) absorbed by lawn grass. From this calculation, we can say whether the university space is comfortable enough for students' recreation and leisure (Table 6).

Table 6

Lawn absorbing carbon dioxide

Area, m^2	CO_2, g/ m^2	Carbon dioxide absorption by the lawn per hour, g	Absorption of carbon dioxide by the lawn per day, kg	Carbon dioxide exhaled by a person per hour, g	Theoretical calculation of CO_2 absorption by a lawn, g/m^2
1000	1,5	1500	36	40	14000

Source: based on own research

A 1000 m² lawn can absorb approximately 36 kg of carbon dioxide per day. This is instrumental in establishing a favorable microclimate and ensuring comfortable conditions for staying in this environment.

Conclusions. The lawn cover in the park area of Vinnytsia National Agrarian University is composed predominantly of turf-forming grasses such as *Poa pratensis* L., *Festuca rubra* L., *Agrostis tenuis*, *Agrostis stolonifera* L., *Lolium perenne*, and *Agropyron cristatum* L. These species hold significant value for their combination of decorative, ecological, and practical qualities, making them ideal for landscaping diverse functional areas. Among these, *Poa pratensis* L. stands out as particularly versatile because of its ability to withstand harsh winter conditions and resistance to trampling, as confirmed by economic and valuable indicators. Lawn grasses exhibit significant decorative, anti-erosion, and fodder benefits. Their height growth depends on biology, nutrients, and environmental adaptability, especially in the second year. Observations indicate that most species recover steadily after winter, progressively forming dense herbaceous layers. July typically marks the peak height for these plants, irrespective of the species. And the research reveals that *Festuca rubra* L. can grow up to 98 cm in height, *Agrostis tenuis* reaches 80 cm, *Agropyron cristatum* L. grows to 65 cm, *Poa pratensis* L. to 61 cm, and *Agrostis stolonifera* L. to 30 cm. It highlights that most lawn grass species are mesotrophs, meaning they have moderate soil fertility requirements. Additionally, these plants are predominantly classified as meadow species based on their life forms. Among them, fescue species exhibit the highest level of drought resistance.

References

1. Havryliuk O., Hovorukha V., Bida I., Danko Ya., Gladka G., Zakutevsky O., Mariychuk R., Tashyrev O. (2022). Bioremediation of Copper- and Chromium-Contaminated Soils Using *Agrostis capillaris* L., *Festuca pratensis* Huds., and *Poa pratensis* L. Mixture of Lawn Grasses. *Land*. Vol. 11 (5), P. 623. DOI: https://doi.org/10.3390/land11050623 [in English].

2. Honcharuk I.V., Pantsyreva H.V., Bronnikova L.F. (2023). Formuvannya hazonnykh trav na osnovi gruntozberezhennya v umovakh parkovoyi zony VNAU [*Formation of lawn grasses based on soil conservation in the conditions of the park zone of VNAU*]. *Zbalansovane pryrodokorystuvannia - Balanced natue using.* № 3. DOI: 10.33730/2310-4678.3.2023.287824 [in Ukrainian].

3. Lutkovska S. (2020). Methodical approaches to evaluation of the processes of modernization of the environmental sustainable system. *Scientific Horizons*. Vol. 23, № 02 (87). 111-118. DOI: 10.33249/2663-2144-2020-87-02-111-118. [in English].

4. Matusiak M.V. (2024). Osoblyvosti rozmnozhennia ta perspektyvy vykorystannia pazhytnytsi bahatorichnoi v kulturfitotsenozakh m. Vinnytsi. [*Peculiarities of reproduction and prospects of using perennial ryegrass in cultural phytocoenoses of Vinnytsia region*]. *Ahrarni innovatsii - Agrarian Innovations*. № 27. DOI: https://doi.org/10.32848/agrar.innov.2024.27.23 [in Ukrainian].

5. Matusiak M.V., Varhatiuk O.V. (2020). Vyznachennia dekoratyvnosti ta uspishnosti introduktsii vydiv rodu Forsythia Vahl. v umovakh biostatsionaru VNAU [*Determining the decorativeness and success of the introduction of species of the genus Forsythia Vahl. in the conditions of the biostationary of the VNAU*]. *Visnyk Umanskoho natsionalnoho universytetu sadivnytstva - Bulletin of Uman National University of Horticulture*. № 1. DOI: 10.31395/2310-0478-2020-1-124-128 [In Ukrainian].

6. Kozłowska M., Bandurska H., Włodzimierz B. (2021). Response of Lawn Grasses to Salinity Stress and Protective Potassium Effect. *Agronomy*. Vol. 11, Issue 5. № 2. P. 843. DOI: https://doi.org/10.3390/agronomy11050843 [in English].

7. Puyu V., Bakhmat M., Pantsyreva H., Khmelianchyshyn Y., Stepanchenko V., Bakhmat O. (2021). Social-and-Ecological Aspects of Forage Production Reform in Ukraine in the Early 21st Century. *European Journal of Sustainable Development.* Vol. 10, № 1. P. 221-228. DOI: https://doi.org/10.14207/ejsd.2021.v10n1p221 [in English].

8. Pantsyreva H., Vovk V., Bronnicova L., Zabarna T. (2023). Efficiency of the Use of Lawn Grasses for Biology and Soil Conservation of Agricultural Systems under the Conditions of the Ukraine's Podillia. *Journal of Ecological Engineering*. Vol. 24, № 11. P. 249-256. DOI: https://doi.org/10.12911/22998993/171649 [in English].

9. Tsyhanska O., Pantsyreva H., Dolinska O. (2024). Analysis of vertical landscaping and recommendations for its improvement in the closed environment. *Silske hospodarstvo i lisivnytstvo − Agriculture and forestry*. № 3 (34). P. 171-181. DOI: 10.37128/2707-5826-2024-3-15 [in English].

10. Tsyhanska O.I. (2022). Osoblyvosti stvorennia ta ekspluatatsii sadiv u styli «Nova khvylia» na sadovo-parkovykh obiektakh Vinnychyny. [*Peculiarities of creating and operating gardens in the "New Wave" style at garden and park facilities in Vinnytsia region.*]. *Silske hospodarstvo i lisivnytstvo − Agriculture and forestry*. № 2 (25). 198-206. DOI: 10.37128/2707-5826-2022-2-15 [in Ukrainian].

11. Tarun K., Saurabh M. (2023). Lawn grasses and their method of establishment: A review. *International Journal of Advanced Biochemistry Research*. Vol. 7, Special Issue 2, Part a. P. 41-50. DOI: 10.33545/26174693.2023.v7.i2Sa.189 [in English].

12. Vdovenko S., Matusiak M., Danyliuk B. (2023). Perspektyvy vyroshchuvannia roslyn rodu *Eustoma* L. v zakrytomu grunti [*Prospects for Growing Plants of the Genus Eustoma L. in Protected Ground*.]. *Silske hospodarstvo i lisivnytstvo − Agriculture and forestry*. № 4 (31). DOI:10.37128/2707-5826-2023- 4-12 [in Ukrainian].

АНОТАЦІЯ
ОСОБЛИВОСТІ ВИКОРИСТАННЯ ГАЗОННИХ ТРАВ ПРИ РЕКУЛЬТИВАЦІЇ ЛАНДШАФТІВ ЗА ЗМІН КЛІМАТУ

У статті наведено результати досліджень можливих варіантів застосування газонних трав при рекультивації ландшафтів за кліматичних змін в умовах Поділля. Визначено, що газонний покрив являється базовим елементом ландшафтної архітектури та зеленого будівництва, виконуючи водночас естетичну, екологічну й рекреаційну функції. Наголошено, що серед трав`янистих рослин, які є перспективними для використання у процесі рекультивації ландшафтів та демонструють значні переваги в умовах кліматичних змін, виділяються представники родини Злакових (Poaceae). Ця родина включає численну групу Світової флори – близько 11 тисяч видів, з яких 420 поширені на території України. Родина Злакових, або тонконогових, об'єднує низку ключових сільськогосподарських культур, таких як пшениця, рис, жито та інші, які відіграють важливе значення в питаннях продовольства у світі.

Експериментальні польові дослідження проводилися у Вінницькому національному аграрному університеті, а саме в ботанічному саду «Поділля» який і виступає об'єктом проведення досліджень входячи у підпорядкування ВНАУ. Ділянка розташована на території рекультивованого ландшафту навколо Храму Вселенських Учителів і Святителів: Василія Великого, Григорія Богослова та Іоанна Златоуста. Предмет дослідження – різновиди трав'яних покривів та компоненти травосумішей. Обґрунтовано, що завдяки екологічній пластичності злакових трав досліджувані види проявили себе невибагливими до умов вирощування, морозовитривалими, види переносять посуху, підвищену вологість та засолення ґрунту. Ці види можна використовувати в різноманітних типах насаджень і на ділянках з різними умовами водного режиму та освітлення. Вони підходять для групових і солітерних композицій, рабаток, міксбордерів, бордюрів, рокаріїв, кам'янистих садів, а також для створення японських садів, моносадів, клумб та підсадок.

Найбільш універсальним у використанні виявився тонконіг лучний (Poa pratensis L.), що за господарсько-цінними показниками виявився зимостійким та проявив стійкість до витоптування. Рослини мають високо-декоративне, протиерозійне та кормове значення. У другий рік вегетації газонні трави мали різну інтенсивність лінійного росту у висоту, що зумовлено їх біологічними особливостями, умовами живлення та екологічною пластичністю. Спостереження показали, що в цей період у більшості видів відзначається стабільне відновлення після перезимівлі та поступове формування щільного травостою. Найвищі рослини незалежно від виду у липні. Відтак, костриця червона сягає у висоту 98 см, мітлиця звичайна – 80 см, житняк гребінчастий – 65, тонконіг лучний – 61 см, мітлиця повзуча – 30 см. Наведено дані про економічну ефективність створення та утримання газонів у межах об'єкту дослідження: територія рекультивованого ландшафту навколо Храму Вселенських Учителів і Святителів: Василія Великого, Григорія Богослова та Іоанна Златоуста. Відтак, загальна вартість для утримання газону за цінами 2025 р. становить 2557 грн на 100 м^2. Створення 100 м^2 газону становить 5512 грн.

Ключові слова: *газон, видовий склад, екологічна стійкість, декоративність, економічна ефективність.*

Табл. 6., Рис. 3., Літ. 12.

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