

DECORATIVE HERBS, A GREEN SOLUTION FOR URBAN ARRANGEMENTS

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Abstract

Grasses or ornamental grasses are increasingly used in contemporary arrangements, both in the composition of lawns and as solitary plants, group, masifs or curbs. The present study was conducted to evaluate the behavior of some decorative grass species/cultivars: *Carex morrowii* 'Snowline', *Carex morrowii* 'Ice Dance', *Festuca glauca*, *Koeleria glauca*, *Miscanthus sinensis* 'Variegatus', *Pennisetum alopecuroides* 'Hameln', *Pennisetum setaceum* 'Rubrum', in different areas of Pitesti. Observations and determinations were made on: biological characteristics, ability to multiply, aesthetic qualities, growing and requirements, winter hardiness, pruning effects, correlated with the variation of average annual temperatures (°C) and average annual rainfall (mm/month) in 2 year of reporting, 2019 and 2020. Ways have been proposed to use the ornamental grasses studied in the landscape arrangements and the importance of their incorporation in the green spaces, for ecosystem offers: restoring the ecological balance, capitalizing on natural resources and developing biodiversity.

Keywords: ecosystem services, grasses, landscaping.

1. INTRODUCTION

One of the important ways, both for the protection of the environment and for the creation of a healthy and pleasant environment for people living in urban areas is the development of green spaces (Iliescu, 2003; Chiriac et al., 2009). The aesthetic function can be highlighted by a rich vegetal palette (ornamental trees and shrubs, floral plants, grass) arranged according to well defined rules of all landscape architecture. Introduction and maintenance of architecture, depending on ecological requirements, morphological features, biological properties, the spatial characteristics of the place where the urban vegetation will be installed, require complex knowledge from the landscape specialist (Badea & Enescu, 2016).

In recent years, the vegetation is facing other challenges generated by the increase of the urban population, climate change (Bojariu et al., 2015), materialized primarily by increasing/decreasing the average annual temperatures/precipitation, decreasing the nursery areas as well as the surfaces of protected areas where the flower material necessary for the two planting seasons is obtained (autumn-spring and summer), the reduction of qualified personnel in the field of dendro-floriculture.

Green spaces have been recognized as a vulnerable ecosystem, with the lowest ecological stability (Grimm et al., 2008) and not always nature, has the means to restore the ecological balance, in many cases requiring human intervention.

Restoring the ecological balance can be obtained by adopting long-term strategies that take into account the capitalization of those natural values of some plant components, as well as the protection of existing ones (Tomaşkin et al., 2015). The use of decorative grasses, in addition to the lawn, giving up seasonal flowering plants that require high costs is a solution adopted in green spaces of Pitești, to solve this issue.

Decorative grasses are increasingly used in landscaping parks and gardens, due to the ornamental qualities that consist in the beauty and naturalness of the port, the texture, the diverse color of the stems, leaves, inflorescences, but also due to the high degree of adaptability to climatic conditions. Both low/medium and high/medium species/cultivars can become a complementary factor in a landscape composition, along with roses, ornamental trees and shrubs, perennial and seasonal flowering plants, lawn, stones, decorative bark. The versatility of these plants can provide both subtle and explosive color effects in different light and shade condition (Rice, 2006), even during the cold season. During the winter they require minimal care, and during the dry periods during the summer, these plants require a low water intake, having an important role in retaining water from rainfall in the soil, thus improving the water regime of the ecosystem (Badea & Enescu, 2016; Tomaşkin & Tomaşkinova, 2015; De Groot R., 2002).

The present study aims to evaluate the behavior of some species/cultivars of decorative grasses, cultivated in the green spaces of Pitești, regarding:

- a) biological characteristics, ability to multiply, aesthetic qualities, growing and care requirements, pruning effects, resistance to climate change, winter hardiness,
- b) ways of using them in landscape compositions,
- d) ecosystem services brought by their incorporation as an integral part of the landscape.

2. MATERIALS AND METHODS

Determinations and observations were made on 7 species/cultivars of decorative grasses, planted in the green spaces of Pitești, following:

Carex morrowii 'Snowline',

Carex morrowii 'Ice Dance',

Festuca glauca,

Koeleria glauca,

Miscanthus sinensis 'Variegatus',

Pennisetum alopecuroides 'Hameln',

Pennisetum setaceum 'Rubrum'.

They belong to the *Cyperaceae* and *Poaceae* families and fall in to the category of perennial plants that ensure their survival from one year to the next through the buds on the roots or through underground formations, called rhizomes. The rapid expansion that the plants in this families have been enjoying lately is due to the high capacity for multiplication through this application. (Brand, 1999; Toma, 2005). The plants were purchased in pots from specialized companies and were planted in the spring of 2019. 10 pots of each species/cultivar were kept in order to multiply vegetatively, in their own production sectors. The preserved plants were kept for 1 year in the nursery, where they benefited from specific care works for the development of the bush. This was followed by the division into smaller formations, with their own roots that were transplanted into pots. They need 1-2 years to reach the optimum size for planting at the place of decoration.

In the green spaces, land preparation involved: clearing the soil at 28 cm, followed by crushing and leveling it. Then spreads the Agrotexil foil over the surface of the land to be arranged (Figure 1a).

Both the pots with decorative grasses and the other ornamental woody plants were placed over the Agrotexsil foil, according to the planting sketch. The grasses were taken out of the pot and planted with a bale at the root, in 30/30 cm holes. The soil tightened tightly around the root. Planting distances were different, depending on the size of the plants.

For the association with other ornamental woody plants, the color of the foliage, the waist and the habitus at maturity were taken into account. After planting, the empty spaces between the plants were filled with stone or decorative bark, in different colors, to achieve pleasant contrasts (Figure 2 b).

The care work was minimal, given the advantages of Agrotexsil foil that prevents the development of weeds, prevents evapotranspiration, plants no longer need to be mobilized and the fact that all planted areas benefit from sprinkler irrigation system, with automatic programming. No specific growth control work was carried out during the growing season.



a)



b)

Figure 1. Land leveling and picketing

Figure 2. Location of Agrotexsil foil

At the end of autumn 2019, some of the grasses whose leaves had dried were cut off, and the others whose leaves did not lose their decorative appearance remained as such. The pruned plants were not covered at the base with protective materials.

The following spring, some of the pruned specimens did not resume their vegetation, and will be replaced with new ones, for which no pruning works were applied at the end of autumn, 2020. During the growing season, determinations and observations were made on:

- 1) ability of multiply,
- 2) the behavior of decorative grasses according to ecological factors (temperature, humidity),
- 3) plant height,
- 4) decorative character (color of leaves, flowers or inflorescences, persistence of foliage),
- 5) the effects of pruning in terms of winter resistance.

Conclusions and recommendations were formulated regarding the use of ornamental grasses in the pedoclimatic conditions of Pitești municipality and the benefits brought to the urban ecosystems.

3. RESULTS AND DISCUSSIONS

1. The species/cultivars studied were evaluated for systematic classification, biological traits and breeding abilities (Table 1).

Table 1. Evaluation of species/cultivars in terms of biological properties and multiplication abilities

Species/Cultivars	Family	Persistency	Type of propagation	Propagation success	Growth tipe	Cutting	
						2019-2020	2020-2021
<i>Carex morrowii</i> 'Snowline'	<i>Cyperaceae</i>	PG	VEG	VG	CG	-	-
<i>Carex morrowii</i> 'Ice Dance'	<i>Cyperaceae</i>	PG	VEG	VG	CG	-	-
<i>Festuca glauca</i>	<i>Poaceae</i>	PG	VEG	VG	CG	-	-
<i>Koeleria glauca</i>	<i>Poaceae</i>	PG	VEG	VG	CG	-	-
<i>Miscanthus sinensis</i> 'Variegatus'	<i>Poaceae</i>	PG	VEG	VG	RG	Cutting	Not cut
<i>Pennisetum alopecuroides</i> 'Hameln'	<i>Poaceae</i>	PG	VEG	G	RG	Cutting	Not cut
<i>Pennisetum setaceum</i> 'Rubrum'	<i>Poaceae</i>	PG	VEG	G	RG	Cutting	Not cut

VEG – vegetative; VG – very good; G – good; PG – perennial grass; CG – clump grass; RG - rhizomatous grass

A very successful multiplication was observed in the *Miscanthus* (Figure 2 a); *Festuca* (Figure 2 b) and *Carex* (Figure 3 c) plants from which at least 10 plants/year can be obtained. At last 3 plants/year can be obtained from plants of the genus *Pennisetum*, which means a good ability to multiply.



Figure 2. Vegetative propagation at *Miscanthus* (a) *Carex* (b) and *Pennisetum* plants (c)

2. The behavior of decorative grasses towards ecological factors (temperature, water). According to studies, the average air temperature shows only statistically significant growth trends throughout Romania during spring and summer, which could lead to major changes in perennial plant

cultivation technologies in general (Păltineanu et al., 2018). There are also trends in rising winter air temperatures in the central and northeastern areas of the country. Autumn is the only stable season in terms of temperature (Dumitrescu & Birsan, 2015). From the recorded data, in the period 2010-2020, there was an increase in the average annual air temperature by 0.4°C (the average temperature in July increased in 2020 by 1°C , compared to 2019 (from 21.1°C to 22.1°C), while the average temperature of the coldest month (January) increased by 1.5°C (0.3°C compared to -1.2°C), (Figure 3).

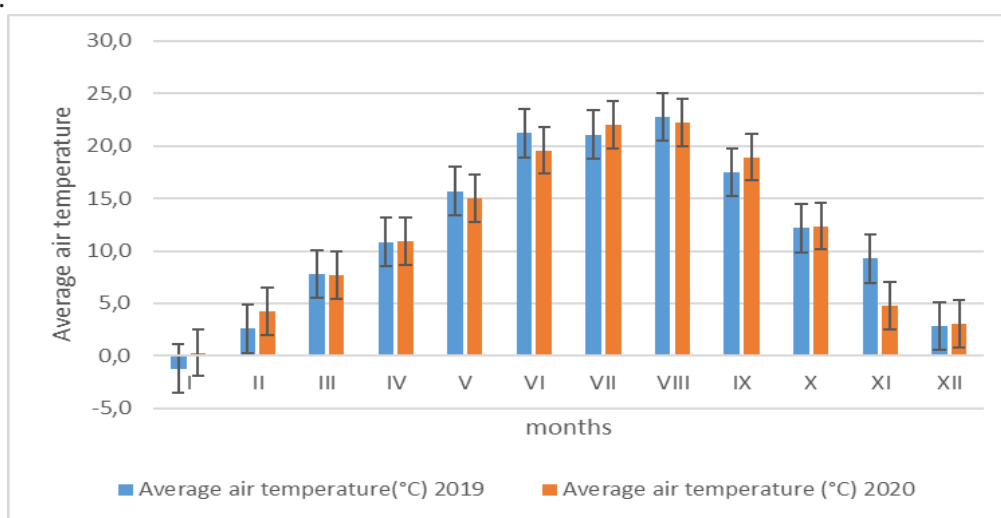


Figure 3. Average monthly air temperature ($^{\circ}\text{C}$)

Regarding the rainfall regime, although the annual amount of precipitation was higher in 2020 (679.1 mm), compared to 2019 (634.7 mm), mainly due to the increase in air temperature, the water deficit from March to September increased (Figure 4). This did not affect the growth and development of ornamental grasses, because these being adapted to a wide range of planting conditions (Toma, 2002).

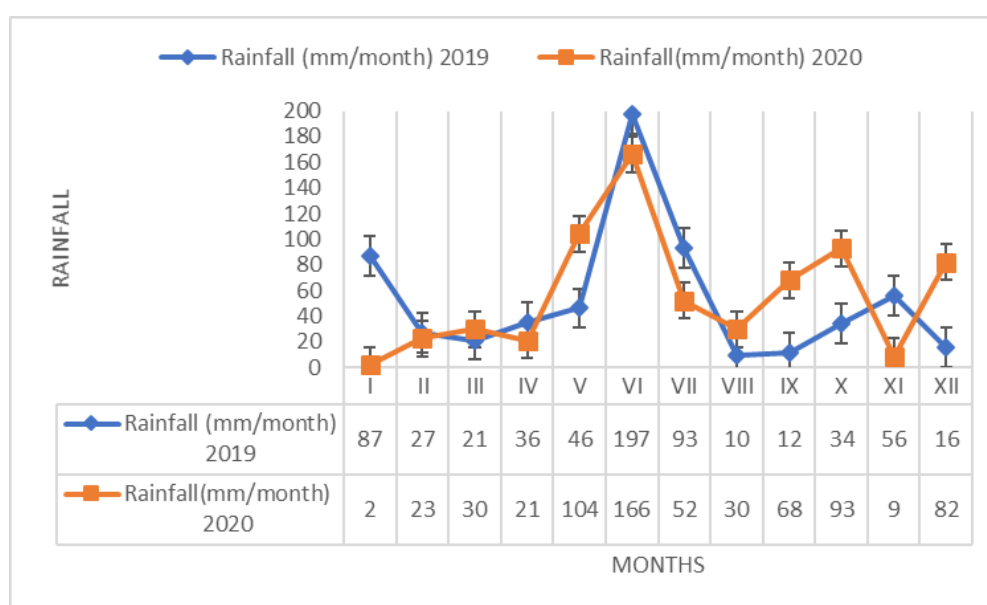


Figure 4. Average monthly rainfall (mm/month)

Observations and data collected on height, flowering period, ornamental character and persistence over the winter, as well as the effects of pruning were summarized in Table 2.

Table 2. Observations and data on height, flowering period, ornamental character, cutting effects on the studied species/cultivars

Species/Cultivars	Plant height (m)	Flowering period (month)	Ornamental effect	Overwintering	
				Cutting	Not cut
<i>Carex morrowii</i> 'Snowline'	20	VI-VIII	L	VG	VG
<i>Carex morrowii</i> 'Ice Dance'	20	VI-VIII	L	VG	VG
<i>Festuca glauca</i>	30	V- IX	L	VG	VG
<i>Koeleria glauca</i>		VI-VII	L	VG	VG
<i>Miscanthus sinensis</i> 'Variegatus'	1,00	IX-XII	WP	P	VG
<i>Pennisetum alopecuroides</i> 'Hameln'	80	VII-IX	I	D	VG
<i>Pennisetum setaceum</i> 'Rubrum'	80	VII-IX	L/I	D	VG

L – leaves; WP – whole plant; I - inflorescences; VG – very good, P – poor; D-dead

The height of the studied plants reached normal values, depending on the characteristic features of each genus, species or cultivar. The highest height, 100 cm, was reached by *Miscanthus sinensis* 'Variegatus', followed by cultivars of the genus *Pennisetum*, which recorded values close to 75 and 80 cm. The lowest height was obtained by *Koeleria glauca*, 25 cm.

The observations made on the flowering period, highlighted the fact that *Festuca glauca* carries out the process of formation, growth and development of the inflorescences starting with May and is staggered until September. *Pennisetum alopecuroides* 'Hameln' and *Pennisetum setaceum* 'Rubrum' bloomed between July and September, and *Koeleria glauca* between June and July. The cultivars studied belonging to the genus *Carex*, *Carex morrowii* 'Snowline' and *Carex morrowii* 'Ice Dance' decorated with their inflorescences between June and August.

Regarding the ornamental effects of the plants studied in landscaping, by the port, the color and persistence of the foliage, the color and persistence of the inflorescences, but also by the special contrasts with the other components of a landscaping, the following were found:

1. *Festuca glauca* and *Koeleria glauca* retain their specific bluish-gray color of the leaves even in the cold season, so they are very suitable for planting in areas of major visual impact (road intersections, roundabouts, at the base of woody plants, in pots decorative), making beautiful contrasts with decorative stone, sand, gravel, wood, decorative bark, water, others ornamental plants (Figure 5).

2. The mosaic appearance of the leaves of species and cultivars of the genus *Carex* (green with white, green with yellow, green with pink tint) gives them a special aesthetic note, being suitable for landscaping with stones, decorative bark, planted at the base of trees or shrubs, alone or in combination with other species or cultivars with darker foliage (*Thuja*, *Cryptomeria*, *Picea*, *Berberis* etc.), (Figure 6).

3. Species and cultivars of the genus *Miscanthus* due to their vegetative volume as well as the attractive shades of the foliage have been very well distinguished on lawns, on the edge of water

arrangements, arranged alone or in groups that include other categories of ornamental plants, stones, decorative objects, street furniture.

4. The red color of the cultivar *Pennisetum setaceum* 'Rubrum' creates very attractive contrasts both with the decorative materials (bark, stone, rocks) of light color, but also with the green of the lawn (Figure 7), iar *Pennisetum alopecuroides* 'Hameln' it is also decorative by inflorescence, in autumn (Figure 8).

5. All the studied plants intensify their decorative character at the time of flowering, especially if there are other perennials in the vicinity that bloom simultaneously (*Lavandula*, *Kniphofia*, *Hosta*, *Heuchera*, *Hemerocallis*, *Rudbeckia*, *Salvia* etc.)

6. Both species with evergreen leaves of the genera *Carex* and *Festuca* and those decorated with inflorescences, *Miscanthus sinensis* 'Variegatus', *Pennisetum alopecuroides* 'Hameln', *Pennisetum setaceum* 'Rubrum', *Koeleria glauca* make picturesque combinations with snow, the inflorescences being special ornaments of the winter landscape.



Figure 5. *Festuca glauca*, *Koeleria glauca* in combination with bark, stones and seasonal flowering plants



Figure 6. *Carex morowii* 'Ice Dance' with bark and other ornamental plants



Figure 7. Color contrast with *Pennisetum* cultivars



Figure 8. *Pennisetum alopecuroides* 'Hameln' in autumn

Ornamental grasses can also be used successfully in decorative pots, at the base of taller plants (Figure 9) as well as in planters or as borders (Figure 10).

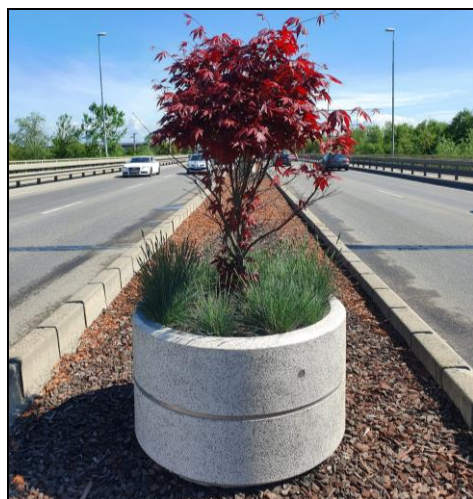


Figure 9. Decorative herbs in pot



Figure 10. Decorative herbs for curbs

The operation of pruning grasses, especially those that do not keep their foliage over the winter is not recommended (Toma, 2002)), especially if they are not covered at the base with protective materials. This sometimes limits their use in landscaping. If in the first year the ornamental grasses are properly protected, in the second year they become much more resistant to temperature fluctuations. In the first year after planting, the plants that do not keep their foliage over the winter were cut at the end of November: *Miscanthus sinensis* 'Variegatus', *Pennisetum alopecuroides* 'Hameln' and *Pennisetum setaceum* 'Rubrum'. These did not resume their vegetation the following spring. The observations showed that left uncut in the autumn of the following year, the plants resumed their vegetation after the winter season.

4. CONCLUSIONS

The study on the evaluation of decorative grass species/cultivars used for the decoration of green spaces in some areas of Pitești municipality indicated the formulation of the following conclusions:

1. The aesthetic value of ornamental herbs is based on:

a) the color of the foliage (*Carex morrowii* 'Snowline'; *Carex morrowii* 'Ice Dance'; *Festuca glauca*; *Koeleria glauca*; *Miscanthus sinensis* 'Variegatus'; *Pennisetum alopecuroides* 'Hameln'; *Pennisetum setaceum* 'Rubrum');

b) ornamental inflorescence (*Festuca glauca*, *Koeleria glauca*, *Miscanthus sinensis* 'Variegatus'; *Pennisetum alopecuroides* 'Hameln'; *Pennisetum setaceum* 'Rubrum');

2) Ornamental herbs have a high degree of plasticity, are not affected by temperature fluctuations, humidity;

3) Ornamental grasses that do not retain their foliage over the winter are not cut in late autumn, but in the following spring when they start growing;

4. In any season, ornamental grasses can be a component of landscape creations, along with other ornamental wood species, flowering plants, decorative accessories or street furniture;

5. The introduction of ornamental herbs into the landscape helps to restore the ecological balance, capitalize on natural resources and develop biodiversity.

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