

Original Article

The Behavior Study of Landscaped Slopes Related with Iulius Mall Cluj Napoca Green Space

VOEVOD Mihai¹, Marcel DÎRJA^{1*}, Adela HOBLE¹,
Mihaela Simona VARVARA¹, Ancuța RADU (TENTER)¹, Istvan Botond SZILAGY¹

*University of Agricultural Sciences and Veterinary Medicine Cluj - Napoca, Mănăştur St., No. 3 – 5,
400327 Cluj-Napoca, Romania*

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Abstract

Soil erosion manifests on slopes and sandy soils with high intensity by the action of water or wind, if they are not protected by vegetation cover compact, consisting of herbaceous vegetation or forest. Drip irrigation is a method of irrigation with high frequency application of water in and around the root zone of plants (crop) and consists of a network of pipes with suitable emitting devices. By using drip irrigation, the water saving compared to conventional surface irrigation is about 40-60% and the yield can be increased up to 100%. The studied slopes are related with Iulius Mall Cluj Napoca Green area. The climate data refer to average temperature, maximum and minimum, annual and monthly atmospheric precipitates. Shrubs species that were used to stabilization slope are: *Euonymus fortunei* and *Cotoneaster horizontalis*, knowing that this species protects soil against erosion. For the landscape designing of slope was used 3D software RealTime Landscaping Architects. Slope has an area of 630 m² and has a western exposes. For the irrigation systems were used surface pipes which were fixed with drip tube clamps together. Also to prevent erosion and runoffs was used as substrate cover biodegradable netting jute and expanded. In conclusion, drip irrigation system shows more advantages to be used on eroded slopes such as: it provides flexible water applicants above and below the soil surface without disorder the land cover stabilization of eroded slopes.

Keywords: land drip irrigation, erosion, irrigation system, slope.

1. Introduction

Soil erosion manifests with high intensity on slopes and sandy soils by the action of water or wind, if they are not protected by vegetation cover compact, consisting of herbaceous vegetation or forest ([8, 10]. Soil erosion include detachment, transport and deposition [2, 3, 6, 7, 11]. Soil is detached both by raindrop impact and the shearing force of flowing water.

Sediment is transported down slope primarily by flowing water, although there is a small amount of down slope transport by raindrop splash [4].

Drip irrigation is a method of irrigation with high frequency application of water in and around the root zone of plants (crop) and consists of a network of pipes with suitable emitting devices. By using drip irrigation, the water saving compared to conventional surface irrigation is about 40-60 % and the yield can be increased up to 100 % [9].

2. Material and Method

For a description of climate date specifically study area where inventoried (computed day) all

* Corresponding author.
Tel: +40-264596384
Fax: +40-264593792
e-mail: dirjamarcel@yahoo.fr

weather phenomena recorded in 2013 (365 days). The climate data references to average temperature (Table 1), maximum and minimum, annual and monthly atmospheric precipitates.

The highest temperature recorded was 36.3°C on August 9. The lowest temperature recorded was -11.4°C on January 9.

The maximum wind speed recorded was 75.6 km/h on June 12. Species of shrubs which were used to slope consolidation are: *Cotoneaster horizontalis* and *Euonymus fortunei*. Slope is related with Iulius Mall Cluj Napoca Green area. Data were reported by the weather station 151200 (LRCL) to Latitude of 46.78, Longitude 23.56 and altitude 410 m.



Figure 1. Localization of field surveys
Source: Google Earth

Table 1. Climate data, Cluj-Napoca City (2013)

Data	Value
Annual average temperature:	10.2°C
Annual average maximum temperature:	17.0°C
Annual average minimum temperature:	4.9°C
Annual average humidity:	75.4%
Annual total precipitation:	596,57 mm
Annual average visibility:	9 Km
Annual average wind speed:	8.6 km/h

Table 2. Number of days with extraordinary phenomena. Total occurrences, Cluj-Napoca City (2013)

Total days with rain:	159
Total days with snow:	45
Total days with thunderstorm:	35
Total days with fog:	60
Total days with tornado or funnel cloud:	0
Total days with hail:	2

Euonymus fortunei (winter creeper, fortune's spindle) is a evergreen shrub whit a height between 0.30 to 1.75 m, the root system is branched with a height between 0.50 to 1.2 m, diameter

between 1-1.5 m the species has economic importance in ornamental therm.

It is a species resistant to atmospheric pollution.



Figure 2. *Euonymus fortunei* (original)



Figure 3. *Cotoneaster horizontalis* (original)

Cotoneaster horizontalis (rock spray) is a shrub prostrate with a height between 0.60 to 1.5 m and a diameter between 1,2 to 1,8 m to root system is a bronched with height between 0.70 to 1.5 m, the species has economic importance in ornamental term. It is a species rezistent to pollution, dust and degraded soils.

To realization the slope 3 D used the soft Real Time Landscaping Architect figure 5678 was measured the scale slope which had arranged. These dimensions was introduced in program Real Time Landscapen Architect at the scale (1:100), and then it was realized the actual arrangement of the slope, after this, it was made renderings 3D. Results

regarding plants growing were interpreted using histograms and frequency polygons.

To establish the variability of measured results were determined limits of variation, class interval and class center used histogram I_c was determined with the calculation formula represent the minimum and maximum limits.

$$I_c = \frac{\text{amplitude variation}}{\text{number of classes}} [1]$$

Where: I_c – range class.

3.Results and Discussions

Slope has an area of 630 m² and has a western exposes. For the irrigation system was used surface pipes which were fixed with drip tube clamps together. Also to prevent erosion and runoffs was used as substrate cover biodegradable netting jute and expanded.

The average temperature during the growing experimental year 2013 is 16.8 °C, all records in this period quantity of 376,14 mm rainfall, which represent about 60% of the total amount of rainfall accumulated in 2013.

On the slopes were planted 350 species of *Euonymus fortunei* (Fig. 2) and *Cotoneaster horizontalis* 480 (Figure 5) with a distance of 40 cm between rows and inter-row.

The growing of *Cotoneaster horizontalis* (Table 3) registered the height ranges early in the 9th grade center 41.4 and 93.4 one class center.

Branches (Table 4) are summarized in center 8.5 with 18 classes and in the center of class 14 one class. Annual increases are summarized in Table 5, with 4.4 12 classes center and center 2.4 2 classes.

Table 3. Frequency measurements of the species *Cotoneaster horizontalis* early height class intervals centers

Class interval (cm)	Class center (cm)	f _a	Class interval (cm)	Class center (cm)	f _a
28.0 - 30.9	29.4	5	55.0 - 57.9	56.4	1
31.0 - 33.9	32.4	4	58.0 - 60.9	59.4	1
34.0 - 36.9	35.4	2	61.0 - 63.9	62.4	5
37.0 - 39.9	38.4	4	64.0 - 66.9	65.4	2
40.0 - 42.9	41.4	9	67.0 - 69.9	68.4	3
43.0 - 45.9	44.4	1	70.0 - 72.9	71.4	2
46.0 - 48.9	47.4	1	73.0 - 75.9	74.4	2
49.0 - 51.9	50.4	6	76.0 - 110.7	93.4	1
52.0 - 54.9	53.4	1	TOTAL		50

In table 3 are grouped frequencies of the 50 measurements *Cotoneaster horizontalis* species early height

In formula [1] represented the class intervals of *Cotoneaster horizontalis* for early height is 8,24.

Table 4. Frequency measurements of *Cotoneaster horizontalis* annual branches growth with class intervals and centers

Class interval (cm)	Class center (cm)	f _a
4 - 5	4.5	4
6 - 7	6.5	12
8 - 9	8.5	18
10 - 11	10.5	10
12 - 13	12.5	5
14	14	1

In table 4 are shown *Cotoneaster horizontalis* branch annual species. From the table it fallows that these increases are in the range of 4.14 class.

In formula [1] represented the class intervals of *Cotoneaster horizontalis* for annual branches is 1.

Table 5. Frequency measurements of annual increases in species *Cotoneaster horizontalis* with class interval and centers

Class interval (cm)	Class center (cm)	f _a
2.0 - 2.9	2.4	2
3.0 - 3.9	3.4	8
4.0 - 4.9	4.4	12
5.0 - 5.9	5.4	9
6.0 - 6.9	6.4	8
7.0 - 7.9	7.4	7
8.0 - 8.9	8.4	4

The table 5 are represented *Cotoneaster horizontalis* annual growth species. From the table is follows that the species are in the range of 2.8

with frequency occurrence 12 in class center 4-4.9. In formula [1] represented the class intervals of *Cotoneaster horizontalis* for annual increase is 0.62

Table 6. Frequency measurement values on *Euonymus fortunei* species early height, with class intervals and centers

Class interval (cm)	Class center (cm)	f _a	Class interval (cm)	Class center (cm)	f _a
27.0 - 29.9	28.4	8	54.0 - 56.9	55.4	1
30.0 - 33.9	31.9	3	60.0 - 63.9	61.9	1
34.0 - 36.9	35.4	1	67.0 - 69.9	69.4	1
37.0 - 39.9	38.4	4	70.0 - 73.9	71.9	3
40.0 - 43.9	41.9	9	77.0 - 79.9	78.4	2
44.0 - 46.9	45.4	2	80.0 - 83.9	81.9	2
47.0 - 49.9	48.4	5	90.0 - 93.9	91.9	2
50.0 - 53.9	51.9	6	TOTAL		50

In table 6 are grouped frequencies of the 50 height early measurements species *Euonymus fortunei*. In formula [1] represented the class intervals of *Euonymus fortunei* for early height is 6.5. *Euonymus fortunei* (Table 6). The species

ranges in height early in 9th grade center 41.9 and 61.9 in the center with a single class. Branch are summarized in Table 7, 8.5 center with 16 classes and 12 center with 2 classes. Annual increases are summarized in table 8 center with 15 classes 4.4 and 5.4 center 7 classes.

Table. 7 Frequency measurements on *Euonymus fortunei* branch annual species with class intervals and centers

Class interval (cm)	Class center (cm)	f _a
4 5	4.5	5
6 7	6.5	14
8 9	8.5	16
10 11	10.5	13
12	12	2

In table 7 presents the annual branch species *Euonymus fortunei*. The table shows that the increases are grouped within 4.14 class frequency

occurrence 16 the center of class 8.5. In formula [1] represented the class intervals of *Euonymus fortunei* for annual branches is 0,8

Table. 8 Frequency measurements on annual increases in species *Euonymus fortunei* with class interval and centers

Class interval (cm)	Class center (cm)	f_a
2.0 - 2.9	2.4	7
3.0 - 3.9	3.4	10
4.0 - 4.9	4.4	15
5.0 - 5.9	5.4	7
6.0 - 6.9	6.4	6
7.0 - 7.9	7.4	5

In table 8 are represented annual increases of species *Euonymus fortunei*. The table shows that the species is in the range of 2.7 by frequency

occurrence 15 in the class of center 4.4. In formula [1] represented the class intervals of *Euonymus fortunei* for annual increase is 0.66



Figure 6. Slope stabilization with a) 3D modeling of slope; b) slope *in situ*
Source: Original photo



Figure 7. Slope stabilization with a) 3D modeling of slope; b) slope *in situ*
Source: Original Photo



Figure 8. Slope stabilization with a) 3D modeling of slope; b) slope *in situ*
 Source: Original photo

3. Conclusions

In conclusion, drip irrigation system shows more advantages to be used on eroded slopes such as: it provides flexible water applicants above and below the soil surface without disorder the land cover stabilization of eroded slopes. The plants are well suited to a *Cotoneaster horizontalis* Species eroded slope has the highest growth and most branches. *Euonymus fortunei* and the slope is suitable but has a slower growth compared to *Cotoneaster horizontalis*.

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