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Root Density Assessment of Six Ornamental Shrub Species Used to Stabilize Eroded Slopes in Morău Village, Cluj County

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Abstract. Roots have a mechanic role in soil stabilization on slopes due to their density and fixing manner. Ornamental shrubs were extracted from the experimental slope and measured. The results revealed that the highest density of roots was developed by *Cornus alba* extracted from the lower level of the slope (2.000), while the lowest root density was presented by *Weigelia florida* (0.625) extracted from the upper slope.

Keywords: ornamental shrubs, upper slope, lower slope, root density, lateral root

INTRODUCTION

Soil erosion has devastating consequences on the ecological balance of environment, as far as it diminishes the humus layer and modifies most of the physical, chemical and biological properties of the soil (Louwagie, 2009).

Vegetation on degraded soils has the role of reducing surface water leaking by anchoring and consolidating the soil with the developed roots, protecting the soil against erosion due to rain fall. Roots have a mechanic role in soil stabilization on slopes due to their density and fixing manner. The antierosional effect of vegetation is determined by the density of green matter and of the underground part.

All fields disposed in slopes are predicted to soil erosion caused by the action of rain and/or wind if they are not protected by compact ground cover vegetation composed by herbs, shrubs and trees. Erosion caused by the action of rain drops appears on fields with a minimum slope of 2-3% (Measnicov, 1987).

MATERIALS AND METHODS

Our experimental field is located in Morău village, Cluj County on a slope of 35% degraded by hydric erosion with southern exposure on a glay-loam soil. The characteristic continental climate for the region studied presents mean values of temperature between 8-10°C and average rainfall regime of 800 mm.

Vegetation planted on the degraded slope for its consolidation was represented by *Forsythia suspensa, Berberis thunbergii, Weigelia florida, Lonicera pileata, Cornus alba, Pyracantha coccinea.* Two years old ornamental shrubs were planted in the spring of 2010 with 10 plants per row of each species, distance between plants of 0,75 m on a total surface of 56,25 m^2.

Shrubs were extracted from the experimental slope in august 2011 as follows: two plants from each species – one from the upper level of the slope and one from the lower level. The extracted radicular system was placed in a bowl and gently washed away the remained soil particles, than the number of lateral roots on a given length of primary root of 8 cm has

been counted. Unfortunately, extracting and rinsing the roots is the only available way of accurately measuring lateral root density.

After counting the lateral roots we proceeded computing their density with the following formula:

Root density (Lv) = Lenghth of primary root / no. of lateral roots

RESULTS AND DISCUSSION

The bushy plants studied in our experiment developed different number of lateral roots, this number varying mostly according to the location of the shrubs on the slope. As shown in Tab. 1 it can be observed that most of the shrubs developed similar numbers of lateral roots on a given length of primary root regardless their placement on the slope.

Tab. 1

Root number and density of the studied species

Species	Lateral root		Density	
	Lower slope	Upper slope	Lower slope	Upper slope
Forsythia suspensa	9	11	1.125	1.375
Lonicera pileata	8	7	1,000	0.875
Berberis thumbergii	10	12	1.250	1.500
Cornus alba	16	14	2.000	1.750
Pyracantha coccinea	8	9	1.000	1.125
Weigelia florida	6	5	0.750	0.625

A slightly higher number of roots can be observed on the upper level of the slope in *Forsythia suspensa*, *Berberis thunbergii*, *Lonicera pileata* and *Pyracantha coccinea*. *Weigelia florida* presents the lowest number of lateral roots from all the studied species in our experiment but their number differ from the previous species concerning their placement on the slope: 5 lateral roots on the upper slope and 6 on the lower level. The highest number of roots presented the *Cornus alba* shrubs (between 14 and 16) with the highest number on the lower slope.

Our experimental results revealed that the highest density of roots was developed by *Cornus alba* extracted from the lower level of the slope (2.000), while the lowest root density was presented by *Weigelia florida* (0.625) extracted from the upper slope.

Similar root densities were observed in the lower slope for *Forsythia* and *Berberis* species between 1.125 and 1.250 nevertheless roots of the same species in the upper slope presented a slightly higher density those extracted from the lower level (1.375 respectively 1.500).

CONCLUSIONS

The average number of lateral roots/plant may be misleading in some cases because the average of primary root length varied according to the slope, allowing various length of root along which lateral roots can form. In this case lateral root density decrease parallel to the decrease in the number of lateral roots.

Our experiments on root density revealed that most of the shrubs extracted from the lower slope presented a less developed root system than those extracted from the upper slope, with a value of 0.375 between.

For eroded slope stabilization with ornamental shrubs we recommend *Cornus alba*

and *Berberis thunbergii* species, for they develop quickly a dense root system beginning with the first year after planting.

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