EVALUATED GRASS SOD AND PROPERTIES OF THE ROOT SYSTEM

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ABSTRACT

The main aim of the trial was to evaluate characteristics of root system (length, surface area and volume of roots) at turfgrasses in vineyard in the soil layer 0-150 mm. Further aims were to evaluate selected turfgrass characteristics of used species and cultivars (ground cover, resistance to weed ingression and visual quality ration). The trial was established in a vineyard at village Moravská Nova Ves in autumn 2009. Turf was regularly cut and clippings were returned. Following turfgrass species and cultivars were used: *Festuca rubra trichophylla* (cv. ´Barpearl´ and ´Viktorka´), *Festuca ovina* (´Hardtop´ and ´Jana´) a *Poa pratensis* (´Harmonie´ and ´Miracle´). Turf was maintained by cutting at the maximal height of 10 cm, 6-7 cuts per year. Undisturbed soil probe was sampled at each plot in 2012 year.

Significantly best turf grass characteristics were found at *Festuca rubra trichophylla;* the worst cover and resistance to weeds ingression were realised at *Poa pratensis* and worst general appearance at *Festuca ovina*.

The largest root system was found at *Festuca ovina* (cultivar ´Hardtop´) for all evaluated parameters (length 101.4 $km.m^{-2}$, surface area 45.3 $m^2.m^{-2}$ and volume 1.6 $dm^3.m^{-2}$). The shortest root system was recorded for *Festuca rubra trichophylla*, but the difference was not significantly different. Significantly smaller volume and area of root system was recorded at *Poa pratensis* (cultivar ´Harmonie´).

Key words: roots length, root surface, roots volume, turfgrass, weed ingression

Acknowledgments: This study was supported by Internal Grant Agency, FA MENDELU No. TP 11/2013 Biomass and bioenergetical transformations.

INTRODUCTION

Grasses are one of the most important plant families (*Poaceae*) for humans in the world (Regal, Šindelářová, 1970). Beyond the food production they perform many other ecosystem services for society (e.g. Beard and Green, 1994; Karlen et al., 2003). Their fibrous roots form thick network in a soil which has a beneficial effect to soil structure and soil biota.

Soil is enriched by organic matter through permanent dieback and forming new roots; it increase microbial activity, water infiltration and retention. The largest proportion of the roots is situated in the soil depth to 100 mm (Vítek, Hrabě, 1983). Grass roots are characterized by large surface area (150 – 300 m^2/m^2) what enables effectively use of nutrients and water. These characteristics have a great influence on ground bearing capacity what is important for machinery entrance to vineyards after rain, if spraying or harvest have to be made (Hrabě et al. 2009). Grasslands provide the best protection of soil against erosion of all crops. They intercept raindrops, dissipate their energy by permanent cover and slow overland flow. Also the strongly developed root system protects soil particles against detachment (Hejduk, 2007).

Growing requirements is increasingly subject on a grassing in vineyards. The experiment was established to implement the evaluation of the suitability of grass species. The main aim of the trial was to evaluate characteristics of root system (length, surface area and volume of roots) at turfgrasses in vineyard in the soil layer 0 – 150 mm. Further aims were to evaluate selected turfgrass characteristics of used species and cultivars (cover, resistance against weed ingression and general appearance).

MATERIAL AND METHODS

The experiment was established in a vineyard in terrier of village Moravská Nová Ves in an altitude 199 m. Landscape is flat to moderately pitched; soil is deep, clayey without stones. Long term year sum of precipitations is 542 mm, average temperature 8.3°C. Trial plots were established in inter-rows in autumn 2009 in three replicates. Seeding rate was 50 $kg.ha^{-1}$. Turf was maintained by cutting at the maximal height of 10 cm, clippings were recycled. The soil strip around the vine trunks was was loosened by tiller. Following turfgrass species and cultivars were used: *Festuca rubra trichophylla* (cv. ´Barpearl´ and ´Viktorka´), *Festuca ovina* (´Hardtop´ and ´Jana´) a *Poa pratensis* (´Harmonie´ and ´Miracle´). Turfgrass was exposed to common entry of machinery (soil compaction), maintained by regular mowing (6 – 7 cuts per year).

Evaluation of turf grass characteristics

Visual rating (cover, visual merit and weeds presence) was conducted three times per year (spring, summer, autumn). For this purpose a scale from 1 to 9 points was used according to Classifier for grasses (Ševčíková et al., 2002).

Evaluation of root system

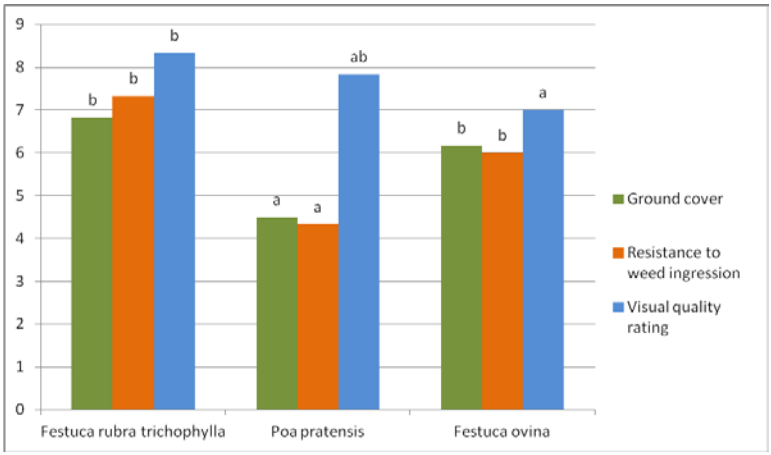
Undisturbed soil probe was sampled at each plot (20 × 80 × 150 mm). Residual aboveground biomass was detached from the soil sample and then roots were washed in water using sieves with mesh size 1.0 mm. Roots were scanned in water for determination of differences in their total length and diameter. Every root system had to be divided to more pictures due to prevention of overlapping of fibrous fine roots which could modify the results. Pictures were analysed using software for image analysis WinRhizo (Regent Instruments Inc. Canada). Differences were analysed statistically by analysis of variance with software Statistica (version 8.0). Multiple comparisons of means were calculated using Tukey's test ($p \leq 0,05$).

RESULT AND DISCUSSION

The best turfgrass characteristics performed *Festuca rubra trichophylla;* ground cover was high and resistance to weed ingression was high. On the other hand the significaly worst evaluation was recorded at *Poa pratensis*; cover was low to medium and resistance to weed ingression low to medium.

Visual quality ration was the best at *Festuca rubra trichophylla* while the worst rating was found out at *Festuca ovina*.

Knot (2009) mentions that in cell walls of leaves of *Festuca ovina* is high content of lignin which causes low cut cleaness (white appearance of turf after mowing). Lignin causes slow degradation of clippings and successive lowering of turf quality. It probably influenced lower rating of the visual merit.



Graf 1 Evaluation of Turf characters, different letters indicate statistically significant

The lowest length of root system was recorded at both cultivars of *Festuca rubra trichophylla*, whereas at cultivar ´Viktorka´ was lower (72.8 $km.m^{-2}$). On the contrary the longest root system was found at *Festuca ovina* ´Hardtop´ (101.4 $km.m^{-2}$). Although the differences in total root length were considerable, they were not statistically significantly different because of high variability.

Greenwood and Hutchinson (1998) found out that in subsurface soil layer 0 – 50 mm of permanent pastures (where most of the root biomass occurs) total length of root system 45.5 $km.m^{-2}$ (91 $cm.cm^{-3}$ of soil). In the soil layer 0 - 750 mm they recorded the total root length 161 $km.m^{-2}$. The reason why their values are much higher in comparison with our results can be that in multispecies sward a complementarity exists which enable more effective sources acquisition.

For *Poa pratensis* cultivar ´Harmonie´ significantly lowest surface area was recorded (33.7 $m^2.m^{-2}$) in comparison with highest value found at *Festuca ovina* ´Hardtop´ (45.3 $m^2.m^{-2}$). For other species and cultivars were not the differences statistically different.

The significantly smallest volume of root system was recorded at *Poa pratensis* cultivar ´Harmonie´ (1.04 $dm^3.m^{-2}$) and the significantly largest at *Festuca ovina*, cultivar ´Hardtop´ (1.6 $dm^3.m^{-2}$).

Statistically significant differences volume of roots among species and cultivars was in *Poa pratensis* cultivars ´Harmonie´ a ´Miracle´ a *Festuca ovina* cultivars ´Hardtop´ a ´Jana´ a *Festuca rubra trichophylla* cultivar ´Viktorka´.

Species	Variety	Length of roots fytomas ($km.m^{-2}$)		Surface of roots fytomas ($m^2.m^{-2}$)		Volume of roots fytomasy ($dm^3.m^{-2}$)	
Festuca rubra trichophylla	Barpearl	77.6	a	36.6	ab	1.38	abc
	Viktorka	72.8	a	36.1	ab	1.44	bc
Festuca ovina	Hardtop	101.4	a	45.3	b	1.60	b
	Jana	97.6	a	41.6	ab	1.47	bc
Poa pratensis	Miracle	97.8	a	37.0	ab	1.15	ac
	Harmonie	89.8	a	33.6	a	1.04	a

Tab. 1 Length, surface and volume of roots of species and varieties, different letters indicate statistically significant

The reason for low roots parameters and low rating of *Poa pratensis* resulted probably from its very slow initial development. Another reason can be choice of fine leaved cultivars which were bred for intensively managed turfgrasses. For vineyards cultivars with more vigorous growth pattern should be preferred.

The aim of subsequent, future research will be evaluation of influence of different grass species on vine. Another important aspect is evapotranspiration rate of individual turfgrass species and influence of their roots on soil characteristics. Lack of water becomes more serious problem but right timing of water and nutrients stress for vine can improve grapes and wine quality.

CONCLUSIONS

Festuca rubra is the most frequently used species for grassing of interrows and fruit orchards. In comparison with other species it performed the best also in this trial from the point of view visual rating. *Poa pratensis* (which was the worst) should be used only in mixtures as its very slow initial growth cannot ensure a sward with low proportion of weeds. Using of modern, dwarf cultivars should be avoided as they require intensive management in terms of irrigation, fertilizing and herbicides use.

Festuca ovina provided the largest root system (total length, volume and surface area) of all tested species. It should be preferably used on dry soils with low nutrients level as it is species adapted for these conditions. According to some authors, fine leaved fescues have very low water consumption what is an advantage in vineyards and fruit orchards without irrigation. On the other hand these species have low wear resistance and does not survive machinery loading esp. in tracks formed by wheels.

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