CORRELATIONS ANALYSIS BETWEEN SOME MORPHOLOGICAL CHARACTERS ON ENERGY WILLOW GENOTYPES

PĂNIȚĂ OVIDIU
University of Craiova, Faculty of Agronomy

keywords: ***stem diameter on the base, total grow/pl., grow/stem, Plant height, no. of stems/pl., area, trend*** model

ABSTRACT

In three different areas, Radovan, Ișalnița and Târburești, there were tested 14 Romanian and Swedish genotypes of energy willow, the analyzed characters being stem diameter on the base, total grow/pl., grow/stem, plant height and. no. of stems/pl. Based on average values recorded for this characters, there were calculated the correlations between those ones, for every area. Stem diameter on the base character is positive correlated with grow/stem character in Radovan and Târburești areas, and with total grow/pl. in the Ișalnița area. Trend models based on linear equation were calculated between grow/stem and stem diameter on the base in the Radovan area and between stem diameter on the base and total grow/pl. in the Ișalnița area. Plant height and no. of stems/pl. characters are in no correlation character regardless of location or character.

INTRODUCTIONS

Salix sp. is a fast growing species and the crop is suitable for the biomass yield. The economic efficiency of this species is given by the high level of biomass yield. It can also be used as a proper crop for soil phytoremediation because of its potential of absorbing heavy metals. *Salix sp.* is a clean source of energy and a way for bio-recovering of degraded fields, becoming very popular and giving benefits to social and environmental areas. Also it is used as raw material for chemical process and manufacturing industry (Pučka**,** 2014). Using renewable energy sources reduces the dependence on fossil fuels and reduces emissions of greenhouse gases (Milan Demo, 2013). The willow crop in SRC is considered a sustainable source of biomass with a positive greenhouse gas (GHG) due to their potential to fix carbon (C) in soil (Cunniff Jennifer, 2015) . On the other hand, willow crops offer some disadvantages such as long period for recovering the initial investment because of its long period of time until it produces the biomass, variability of climatic factors and the variety of high technologies (Pučka**,** 2014).

Bioenergy production based on short rotation coppice plantations (SRC) is widely introduced in some European countries, USA and Canada (Rodzkin, 2012).

Willows have a special place among energy crops due to their high potential in productivity and broad tolerance to environmental factors (Rodzkin A. I. 2015).

The key factor for willow production is the water regime of plants. Willows belong to the group of phreatophytes, having an increased demand for water during vegetation. Therefore, the focus on water regime in willow plants is obligatory in the investigation. Water retention ability represents a physiology indicator related to water use efficiency (Rodzkin A. I. 2015)**.**

Rodzkin et. al. found that diurnal dynamics of transpiration showed one peak (typically at midday) for all clones. Their results are in accordance with the results of transpiration dynamic presented in other publications (Kostjuchenko R.N., 2009).

Proe et al. [10] found that when measuring the net photosynthesis of Salix during the period between May and October in central Scotland, the greatest rates were found in July and September.

Within all plants there exists a functional equilibrium of biomass, where additional biomass is allocated to an organ to take up the resource that is most limiting growth (Bloom A.J., 1985); (Poorter H., 2012), (Reich P.B. 2012). An understanding of these principles is founded in plant ecology, but they have many applications in agricultural research as allocation sets limits on biomass production and utilisation (Poorter H, 2012). Allocation patterns can be affected by numerous environmental factors to varying extents including: light, nutrients, water, elevated atmospheric CO_2, temperature, salinity and mechanical perturbation, and have been reviewed by numerous authors using a plethora of data from environmental manipulation studies; (Poorter H., 2012); (Poorter H. 2000); (Cannell M.G.R., 1994).

The correlations have importance from theoretically and practically point of view, because they emphasize the genetic background of some characters and they allow to conclude on characters and issues which are linked together (Soare, M., 2010).

MATERIAL AND METHOD

This experiment studied the analysis of correlations between some analyzed characters from 14 Romanian and Swedish genotypes of energy willow in different ecological conditions.

The analyzed characters were: stem diameter on the base; total grow/plant; grow/stem; plant height and no. of stems/pl.

The data concerning the values of the character were recorded from three different location: Radovan (medium fertility soil - Control), Tâmburești (sandy soil on irrigation) and Ișalnița (antropomorphic soil formed from coal ash).

Also, it was computed the determination coefficient (R^2), as being equal with the squared value of the correlation coefficient. Depending on the value of the determination coefficient, it was was established the validity of the trend model as shown:

- 0.8-0.9 a very good trend model
- 0.7 a good trend model bun
- 0.3-0.7 insufficiently developed model
- 0-0.3 incorrect model

RESULTS AND DISSCUSIONS

The average values for the analyzed characters are shown in table 1.

Table 1

The average values for the analyzed characters for all genotypes

Nr. rt.	Charter / Genotype	Stem diameter on the se (mm)	Total grow/pl. (m)	Grow/stem (m)	Plant height (m)	No. of stems/pl.
1.	RO 892	15,05	31,56	791,48	129,08	4,57
2.	RO 1077	16,90	36,89	432,84	157,61	5,27
3.	RO 1082	15,12	38,41	577,46	170,25	4,63
4.	Cozia	11,12	24,04	132,49	142,68	4,43
5.	Frgisl	10,65	15,01	112,98	132,75	5,40
6.	Pesred	9,39	13,56	115,40	161,60	4,90
7.	Roisl	9,52	12,44	47,00	129,62	8,62
8.	Inger	16,65	45,75	417,50	137,46	4,55
9.	Tordis	11,96	26,12	182,62	114,47	4,53
10.	Olof	12,64	18,84	199,39	112,38	4,13
11.	Sven	10,39	12,79	71,63	127,53	3,71
12.	Tor	11,40	18,74	209,39	131,74	4,26
13.	Jorr	8,68	13,94	60,47	134,06	3,67
14.	Torhild	9,56	29,61	101,55	178,53	3,83

Concerning the correlation analysis for the recorded values in the Radovan area, it was calculated two correlation coefficients higher than 0.51, the one between total grow/pl. and stem diameter on the base and the one between grow/stem and stem diameter on the base. From those two, importance for the trend model has the one between grow/stem and stem diameter on the base, which has a value of 0.846 (Table 2).

Table 2

The variation of the correlation coefficient for the analyzed characters in the Radovan area

Character	*Stem diameter on the base*	Total grow/pl.	Grow/stem	*Plant height*
Total grow/pl.	**0.597**	-	-	-
Grow/stem	**0.846**	0.487	-	-
Plant height	0.073	0.169	0.279	-
No. of stems/pl.	0.310	0.229	0.317	0.206

P 5%=0.51

Based on this value, it was calculated a trend model based on simple linear regression equation. Thus, when the plants are growing 1 mm in diameter, they accumulate average growing of 2.55 cm/stem (Chart 1).

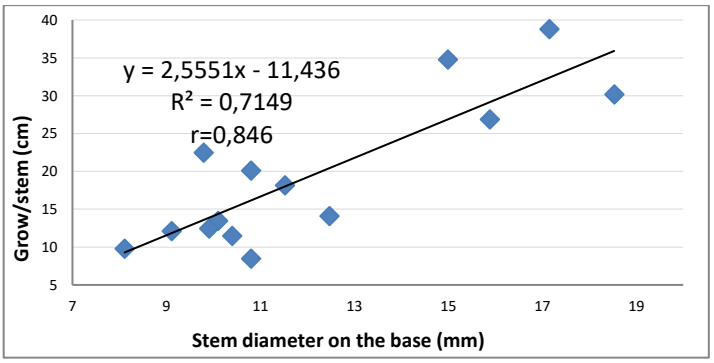

Chart 1 - The analysis of the trend model between stem diameter on the base and grow/stem in the Radovan area

Regarding the correlation analysis for the recorded values in the Tâmburești area, it was calculated three correlation coefficients higher than 0.51, the one between total grow/pl. and stem diameter on the base, the one between grow/stem and stem diameter on the base and the one between total grow/plant and the grow/stem (table 3).

Table 3

The variation of the correlation coefficient for the analyzed characters in the Tâmburești area

Character	*Stem diameter on the base*	Total grow/pl.	Grow/stem	*Plant height*
Total grow/pl.	**0.822**	-	-	-
Grow/stem	**0.822**	**0.771**	-	-
Plant height	0.046	0.266	0.310	-
No. of stems/pl.	0.248	0.023	-0.040	-0.180

P 5%=0.51

Based on the value of determination coefficient (R^2=0.724), it was calculated a trend model based on second degree polynomial equation (Chart 2).

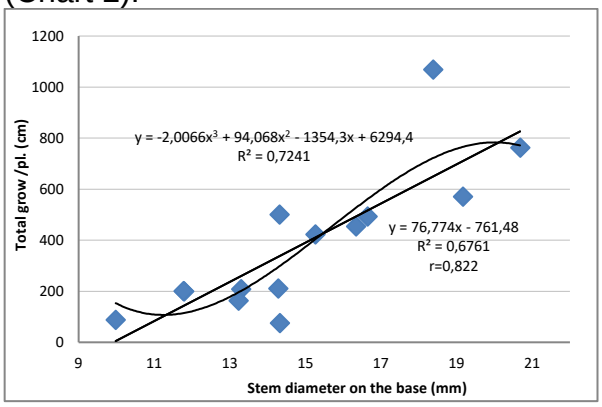

Chart 2- The analysis of the trend model between stem diameter on the base and total grow/pl. in the Tâmburești area

Based on the value of determination coefficient (R^2=0.754), it was calculated a trend model based on second degree polynomial equation (Chart 3).

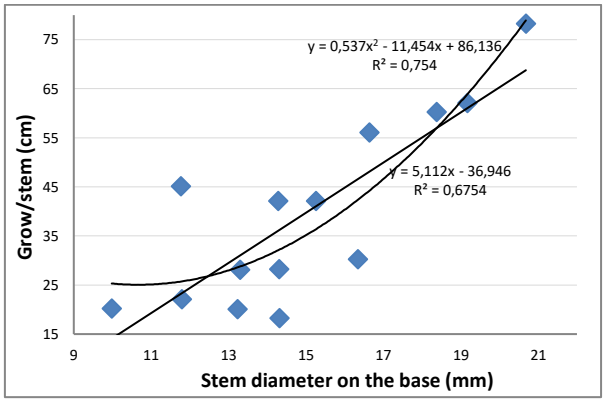

Chart 3 -The analysis of the trend model between stem diameter on the base and grow/stem in the Tâmburești area

Based on the value of determination coefficient (R^2=0.739), it was calculated a trend model based on fourth degree polynomial equation (Chart 4).

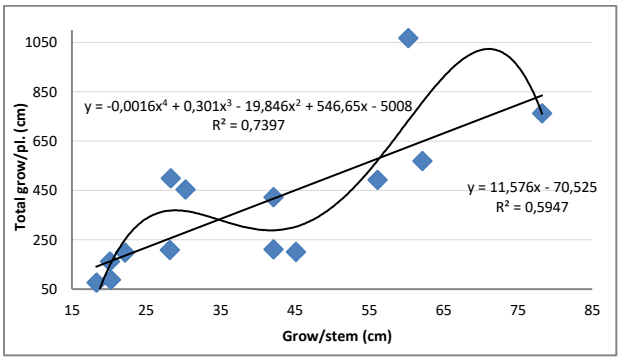

Chart 4 - The analysis of the trend model between grow/stem and total grow/pl. in the Tâmburești area

In the Tâmburești area, it was calculated one correlation coefficients higher than 0.51, the one between total grow/pl. and stem diameter on the base, its value being of 0.977 (table 4).

Table 4

The variation of the correlation coefficient for the analyzed characters in the Işalnița area

Character	*Stem diameter on the base*	Total grow/pl.	Grow/stem	*Plant height*
Total grow/pl.	**0.977**	-	-	-
Grow/stem	0.495	0.565	-	-
Plant height	-0.173	-0.168	-0.011	-
No. of stems/pl.	-0.408	-0.342	-0.311	0.062

P 5%=0.51

Based on this value, it was calculated a trend model based on simple linear regression equation. Thus, when the plants are growing 1 mm in diameter, they accumulate a total grow of 44.04 cm/pl. (Chart 5).

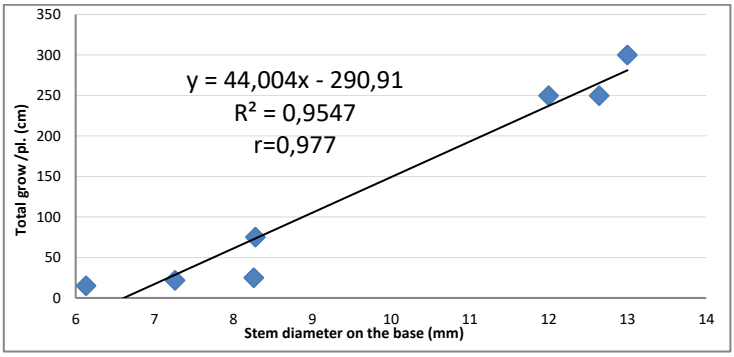

Chart 5 - The analysis of the trend model between stem diameter on the base and total grow/pl. in the Ișalnița area

CONCLUSIONS

1. The stem diameter on the base character correlates positively with grow/stem character in the Radovan and Tâmburești areas and with cu total grow character in the Ișalnița area.

2. Trend model based on simple linear equation were calculated between grow/stem character and stem diameter on the base in the Radovan area and between stem diameter on the base and total grow/pl. in the Ișalnița area.

3. Trend model based on polynomial equation of superior order were calculated between total grow/plant and stem diameter on the base, between grow/stem and stem diameter on the base and respectively between total grow/plant and grow/stem in the Tâmburești area.

4. Plant height and no. of stems/pl. are correlated with no other character no matter the area.

ACKNOWLEDGEMENTS

This paper was financially supported by MEN UEFISCDI, Programme PN II, 2014- 2017, project no. 111, SAROSWE

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