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Original Article

Study upon the Unconventional Solutions of *Pyrus Communis* Fertilization in Nurseries

BORDEANU Bianca Maria, Ioan OROIAN*, Antonia ODAGIU, Ilie COVRIG, Petru BURDUHOS, Sînziana PAULIUC

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

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Abstract

Pear is one of the most consumed fruit all over the world. In Romania also is among most cultivated fruit. It is due, not only to preference of fruit consumers, but also because it is a most valuable raw material for genuine natural beverage product ”tuica”. The trial was developed in a private nursery from Vâlcele, county of Cluj. Pear seedlings (*Pyrus communis* L.) were used. Three fertilization variants were used: NPK (15:15:15) - control, fly ash, and magnetic fertilizer. The seedlings' development was assessed in mid-October, by measuring the shoots' growing, and trunk diameter at 5 cm height above ground. Data were statistically processed with STATISTICA v. 7.0 for Windows. The administration of magnetic fertilizer led to best results, compared to $N_{15}P_{15}K_{15}$ mineral fertilizer and fly ash, concerning the evolution of shoots' height and trunk diameters within nursery conditions. Even though, the use of magnetic fertilizer led to weakest correlation between shoots' height and trunk diameter. These results led us to conclude that further research is needed in order to state the influence of unconventional fertilization upon pear seedlings development.

Keywords: NPK, fly ash, magnetic fertilizer, Pearson correlation.

1. Introduction

Pyrus communis, common pear tree namely, is one of the most consumed fruit all over the world. In Romania also is among most cultivated orchard components, not only due to big popularity among fruit consumers, but also because it is a most valuable raw material for genuine natural beverage product ”tuica”. For this reason, lot of attention is paid to continuous improvements in cultivation technology of the pear tree. In this respect, rearing *Pyrus communis* rootstock in nursery conditions my deliver important output for future development of this tree species [3, 5]. One of the most important component of the tree rearing technology in nurseries is represented by fertilization.

It, usually, is the most important enhancer of nutritional soil supply in elements as nitrogen, phosphorus or potassium [2, 4, 6]. An appropriate soil fertilization lead to suitable valuation of all kind of inputs. If mineral fertilization performed with NPK complex in different ratios is a common practice since long ago. But, ourdays lots of research are oriented towards unconventional fertilization sources [1, 7].

One of them is the possibility of valuation the wood debris ash resulted from their burning in furnaces [3, 7].

If previous chemical analysis of this ash demonstrate that it has appropriate content in one, or all, of the used mineral fertilization elements - nitrogen, potassium or phosphorus respectively, and that it contains no harmful elements or

* Corresponding author.
Fax: +40-264-593792
Tel: +40-264-596384
e-mail: neluoroian@gmail.com

concentrations over limits, it was demonstrated that

Another unconventional fertilization more and more used in last decades is the magnetic fertilizer. Special oxides, chemical elements with magnetic and/or paramagnetic properties, and fixing elements are usually the components of such fertilizers [8].

Our study aims to emphasize the effects of unconventional soil fertilization with fly ash and magnetic fertilizer compared to traditional NPK fertilization upon growing performances, expressed in shootings' height and trunk diameter, of *Pyrus communis* L. in nursery conditions.

2. Material and Method

The trial was developed in a private nursery from Vâlcele, county of Cluj, in 2014, on 764 m^2 experimental area, with 20 m^2 plot size of by variant.

Pear seedlings (*Pyrus communis* L.) were used. The wild pear (*Pyrus communis var. Pyraster* L.) was used as rootstock for scion cultivars of *Pyrus communis* L., due to its large rusticity and because it does not show any graft incompatibility problems. The seedlings were planted in March 2014, and a randomized complete block design with 3 replications and 3 variants was used. Appropriate agro technical and phytosanitary protection measures were carried out by each experimental plot.

Three fertilization variants were used. The variant fertilized with NPK (15:15:15), in doses of 170 kg/ha, was considered control, while the other too variants fertilized with fly ash (2t/ha), and magnetic fertilizer (10 kg/ha) were experimental. Fertilizers were applied in mid-March at planting, and in mid-July.

The seedlings' development was assessed in mid-October, by measuring the shoots' growing, and trunk diameter at 5 cm height above ground.

Statistics. STATISTICA v. 7.0 for Windows was used for raw data processing.

Box-Plot diagrams were used for emphasizing the averages and dispersion parameters represented by the standard error of mean of trunk diameters and shoots' heights reported for each experimental variant, correspondent to different fertilization.

The significance of differences between shoots' heights and trunk diameters function of variants were calculated using the Student test. Pearson correlations were calculated between shoots' heights and trunk diameters, within each variant.

it ca been used as soil fertilizer, or amendment [3].

3. Results and Discussions

The Box – Plot diagram of shoots' heights averages correspondent to each fertilization variant during experimental period (March – October 2014), emphasizes the biggest growing average in variant that received magnetic fertilizer, 42.40 ± 2.15 cm, respectively (Fig. 1). It is followed by control variant that received $N_{15}P_{15}K_{15}$ mineral fertilization with an average of 40.80 ± 1.83 cm, and variant that received fly ash fertilizer, with an average of 38.40 ± 1.62 cm (Fig. 1).

If we analyse the significance of differences between the shoots' height reported for each fertilization variant we find that no significant differences recorded at significance threshold of 5% (Table 1). Even though, if compared to control, we note that the average shoots' height reported in variant fertilized with fly ash is with 2.40 cm lower, and average shoots' height reported in variant fertilized with magnetic fertilizer is with 1.60 cm bigger (Table 1). The shoots' height correspondent to the variant fertilized with magnetic fertilizer recorded an average with 4 cm bigger than shoots' height correspondent variant fertilized with flying ash (Table 1).

Concerning trunk diameter, the Box – Plot diagram emphasizes the averages reported for each fertilization variant during experimental period, March – October 2014, respectively that have the same evolution compared to shoots' height (Fig. 2). Thus, we note the biggest trunk diameter average in variant that received magnetic fertilizer, 9.70 ± 0.33 cm, respectively (Fig. 2). It is followed by $N_{15}P_{15}K_{15}$ mineral fertilized control variant, which had an average of 9.10 ± 0.31 cm, and variant that received fly ash fertilizer, with an average of 8.80 ± 0.39 cm (Fig. 2).

Similarly with situation recorded in analyse of the shoots' height, the study of the significance of differences between the trunks diameters reported for each fertilization variant shows that no significant differences were recorded at significance threshold of 5% (Table 2).

Even though, if compared to control, we note that the average of trunk diameters reported in variant fertilized with fly ash is with 0.30 cm lower, and average of the trunk diameters reported in variant fertilized with magnetic fertilizer is with 0.60 cm bigger (Table 2).

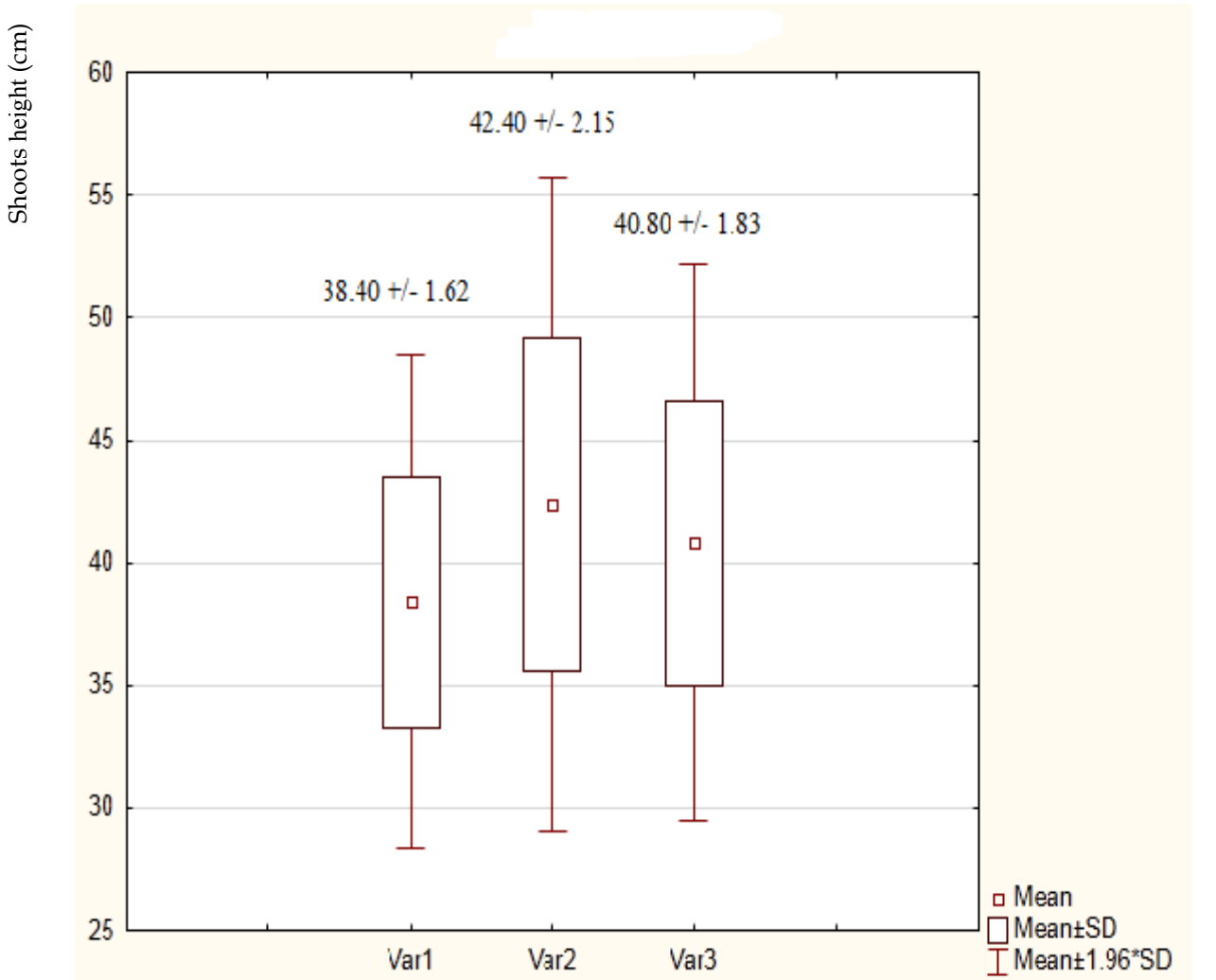
The trunk diameters correspondent to the variant fertilized with magnetic fertilizer recorded an average with 0.90 cm bigger than trunk diameters

correspondent variant fertilized with flying ash (Table 2).

For both analysed parameters, shoots' height, and trunk diameters, respectively, the Box-Plot diagrams emphasize the regular distribution of individual values of the considered samples. This is illustrated by the graphic representation of standard deviation and also by the values of standard errors of means (Figs. 1 and 2).

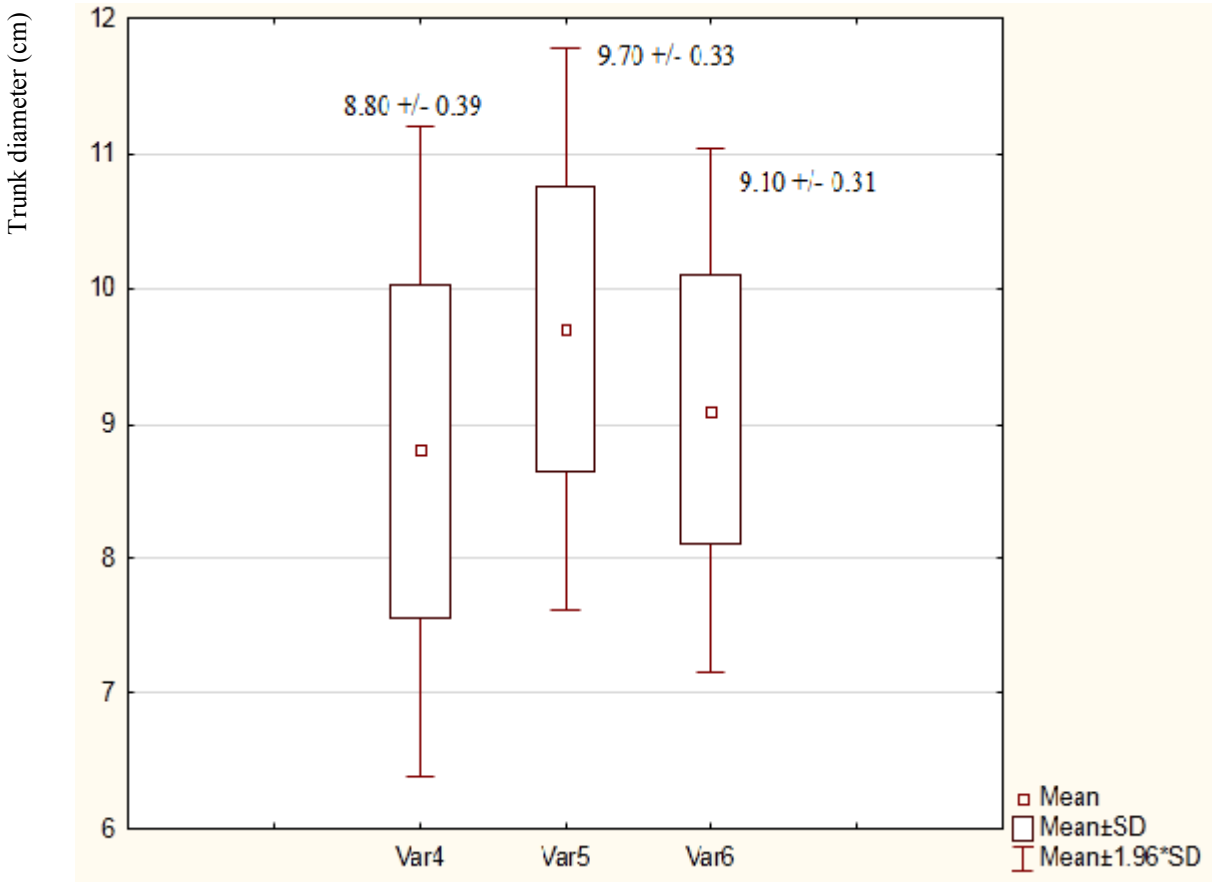
The study of the Pearson correlations between the shoots' height and trunk diameter emphasize the lack of a strong or even moderate interdependence between these two analysed parameters, whatever fertilization variant (Figs. 3 – 5).

Thus, in control variant mineral fertilized with $N_{15}P_{15}K_{15}$ a weak to average correlation of 33.10% was recorded, representative for 10.90% of sample (Fig. 3), while for experimental variants, weaker correlations were reported, lower compared to above mentioned one.



Var 1 – variant fertilized with fly ash; Var 2 – variant fertilized with magnetic fertilizer; Var 3– variant fertilized with $N_{15}P_{15}K_{15}$.

Figure 1. The Box-Plot diagram of shoots' heights averages correspondent to each fertilization variant during experimental period (March – October 2014)



Var 4 – variant fertilized with fly ash; Var 5 – variant fertilized with magnetic fertilizer; Var 6– variant fertilized with $N_{15}P_{15}K_{15}$.

Figure 2. The Box-Plot diagram of trunk diameters averages correspondent to each fertilization variant during experimental period (March – October 2014)

Table 1. Significance of differences between the shoots heights reported function of fertilization variant (cm)

No.crt.	Differences		DF	t	p
1	$V_1 - V_2$	$- 4.00^{ns}$	18	- 1.485	0.154
2	$V_1 - V_3$	$- 2.40^{ns}$	18	- 0.981	0.339
3	$V_2 - V_3$	$+ 1.60^{ns}$	18	+ 0.566	0.578

Var 1 – variant fertilized with fly ash; Var 2 – variant fertilized with magnetic fertilizer; Var 3– variant fertilized with $N_{15}P_{15}K_{15}$;
ns – p > 0.05%.

Table 2. Significance of differences between the trunk diameters reported function of fertilization variant (cm)

No.crt.	Differences		DF	t	p
1	$V_1 - V_2$	$- 0.90^{ns}$	18	- 1.485	0.096
2	$V_1 - V_3$	$- 0.30^{ns}$	18	- 0.981	0.556
3	$V_2 - V_3$	$+ 0.60^{ns}$	18	+ 0.566	0.208

Var 1 – variant fertilized with fly ash; Var 2 – variant fertilized with magnetic fertilizer; Var 3– variant fertilized with $N_{15}P_{15}K_{15}$;
ns – p > 0.05%.

In experimental variant unconventionally fertilized with fly ash a weak correlation of 24.30% was emphasized between analysed traits. It is responsible for 5.90% of sample (Fig. 4). The weakest correlation was reported between shoots' height and trunk diameters in variant fertilized with magnetic fertilizer, 14.10% respectively, responsible only for 1.90% of sample (Fig. 5).

These results emphasize that in control variant treated with mineral $N_{15}P_{15}K_{15}$ fertilizer, was recorded the best interrelation between the trunk diameter and shoots' height development.

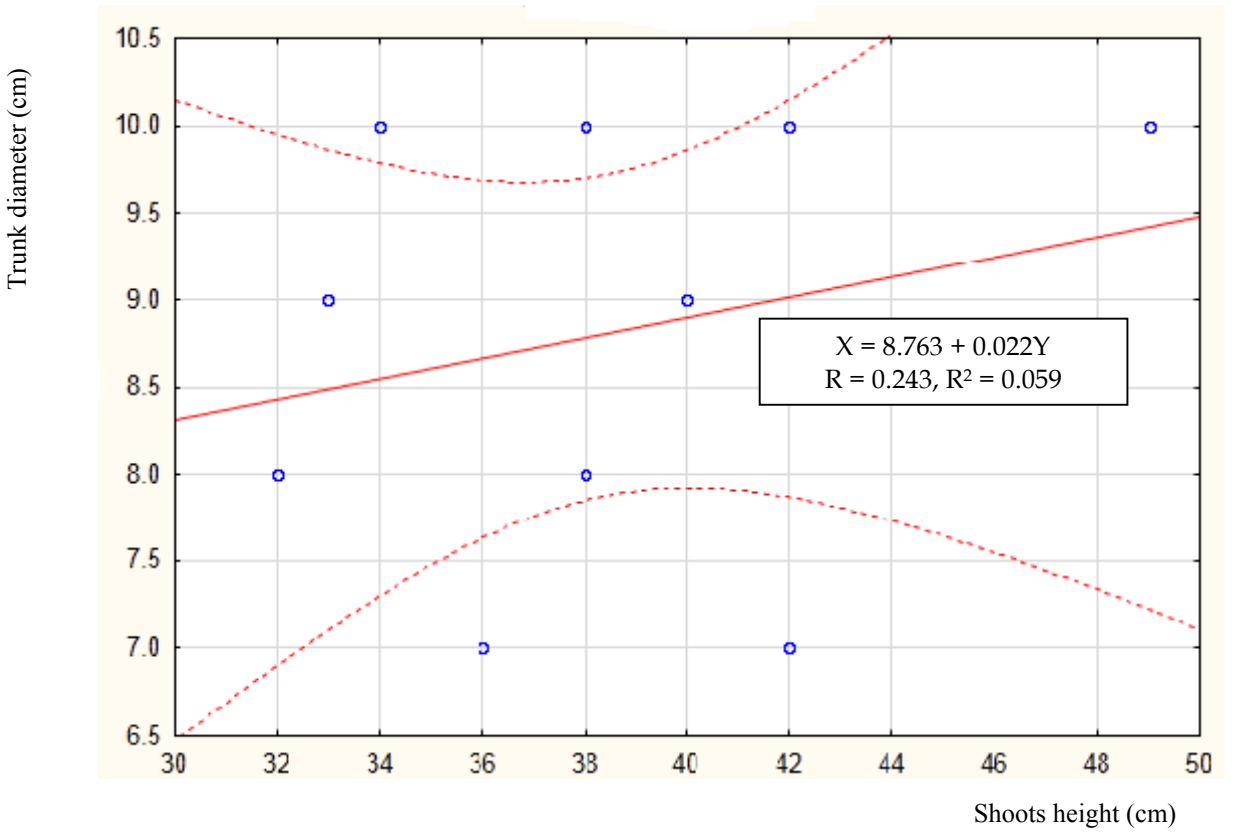


Figure 3. The Pearson correlation between shoots' heights and trunk diameter correspondent to fly ash fertilization variant during experimental period (March – October 2014)

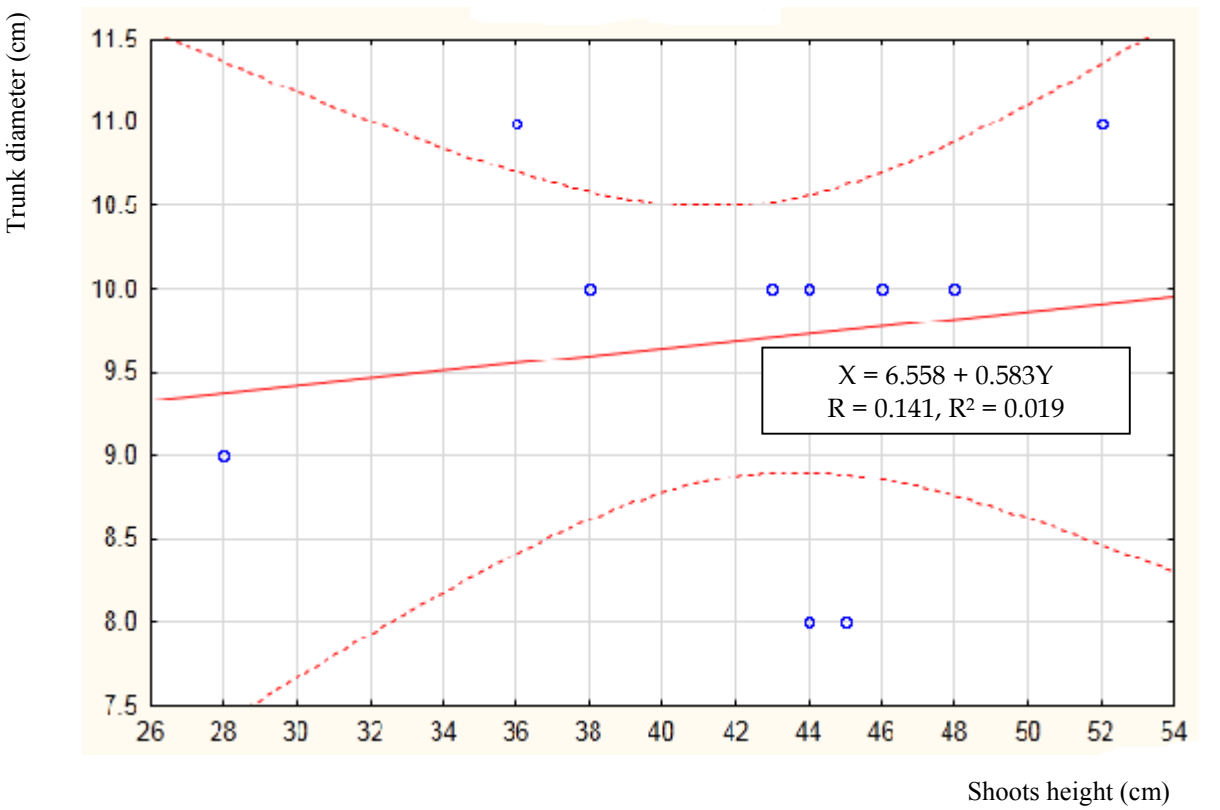


Figure 4. The Pearson correlation between shoots' heights and trunk diameter correspondent to magnetic fertilized variant during experimental period (March – October 2014)

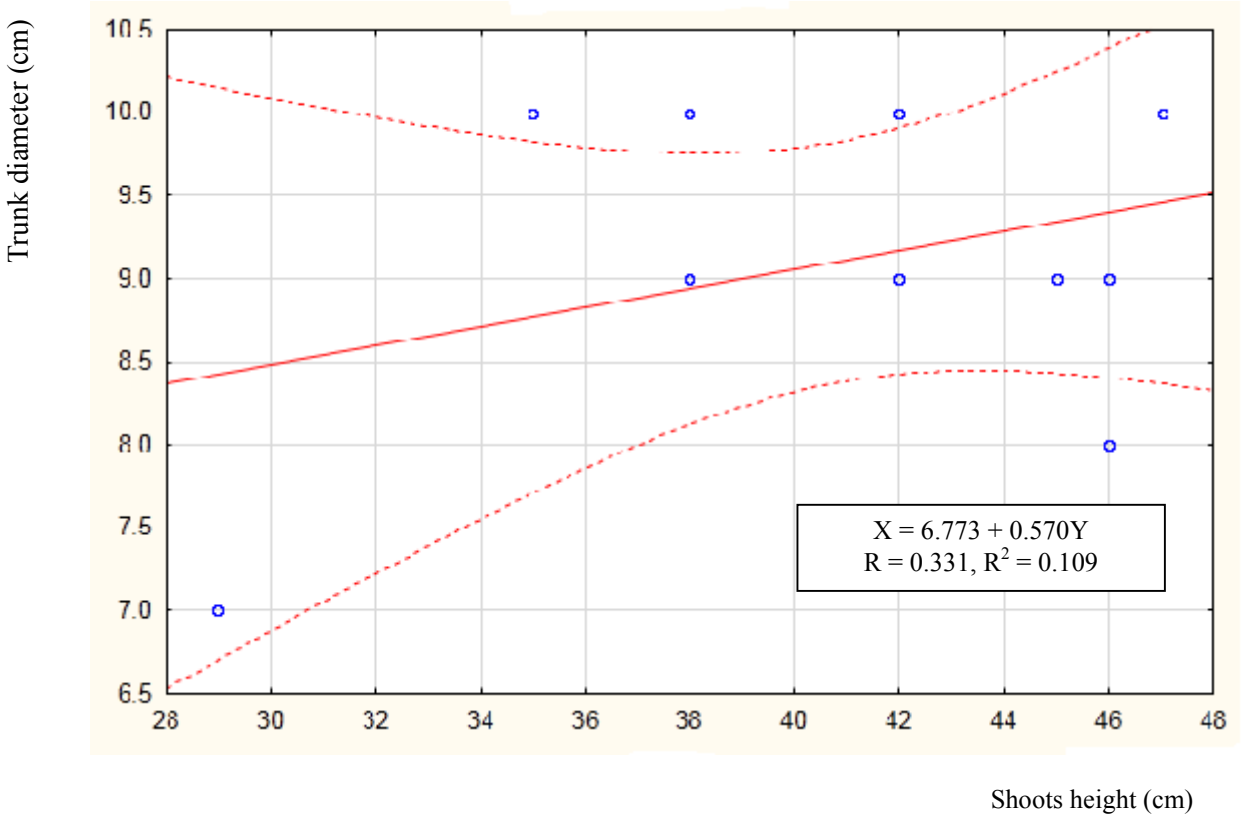


Figure 5. The Pearson correlation between shoots' heights and trunk diameter correspondent to $N_{15}P_{15}K_{15}$ fertilization variant during experimental period (March – October 2014)

Even though, de use of magnetic fertilizer led to best results in both shooters' height and trunk diameters growth, the interrelation between these two important traits of pear tree seedlings is the weakest, while in variant fertilized with fly ash resulted from furnace burning of oak and durmast wood debris, the interrelation was intermediary to control and other experimental variant.

4. Conclusion

The administration of magnetic fertilizer led to best results, compared to $N_{15}P_{15}K_{15}$ mineral fertilizer and fly ash, concerning the evolution of shoots' height and trunk diameters within nursery conditions. Even though, the use of magnetic fertilizer led to weakest correlation between shoots' height and trunk diameter. These results led us to conclude that further research is needed in order to state the influence of unconventional fertilization upon pear seedlings development.

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