

INFLUENCE OF SOIL TILLAGE SYSTEM ON SAPLINGS QUALITY IN THE FORESTRY NURSERIES

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Abstract

The present research has as a purpose the determination of the optimal tillage systems of the soil, used in the forestry nurseries, meant to facilitate the development of saplings of high quality. The research has been carried out in Iarac Forestry Nursery from O.S. Iuliu Moldovan during 2006-2009, on an alluvial soil, the vertical-gleizated subtype. In the present paper, we display the results obtained after the working of the soil in the classical tillage system and minimum tillage system on the dimensional elements of the forestry saplings of ash trees and oak trees (diameter of the collets and height), measured at the mid season of vegetation. The work systems applied have been: classical tillage system (plough + disc 2X) and minimum tillage system (paraplow+ harrow). The usefulness of this paper lays in the research data gathered, processed, analyzed and exploited in order to provide a pertinent study material, which could be effectively used by the specialists in the design of obtaining saplings in the forestry nurseries and the choice of the tillage system for the optimal soil.

INTRODUCTION

The tillage system for the soil has represented and still represents one of the main elements of technology through which one intervenes in order to raise the production of the cultivated plants (forestry saplings), and lately, at an even greater extent, for the optimization of the relation between production-profit- fertility and resources conservation [3].

Soil tillage applied irrationally and, in particular the classical tillage system determined in time a degradation of the soil characteristics, the strong reduction of the content of organic substance and, implicitly, of its productive potential [2].

The soil processing in the classical tillage system leads to an excessive break-up through repeated interventions, leaving it without vegetal remains through the reversal of the clods in the ploughing process, thus being strongly eroded under the action of the water and wind [1].

Worldwide, there is a tendency to replace the classical tillage system of the soil, through the extension of the minimum work system, method recommended both from the viewpoint of soil preservation and for the reduction of energy consumption [6].

In our country, the extension of these systems of soil processing in the forestry nurseries is slow because of the lack of unitary strategies to sustain the technology, the lack of unitary strategies to correspond to the biological requirements of each culture, the lack of specialized knowledge related to the new system [4].

It is important to remember that the unconventional system appeared as an alternative for the reduction of erosion, leaving behind the production level and neglecting at first the advantages related to the fuel consumption [5].

With this system, the objective was to reduce the number of soil tillage which determines the dusting, the subsidence and the lowering of soil fertility. It was proven that, as a result of the excessive exploitation of the prairie soil, the compaction increased with 20% and the porosity decreased with 10%. [8].

Retrospectively analyzing the development of the tillage systems of the soil in Romania, we realize that the research intended to put into practice the tillage systems adequate to the biological requirements of the plant, underlined the way in which the methods of soil exploitation influence its physical-chemical properties, its production and energetic efficiency [7].

MATERIAL AND METHODS

Research was carried in the Iarac Forestry Nursery from O.S. Iuliu Moldovan during 2006-2009, on an alluvial soil, the vertical-gleized subtype. The experiment had poly-factors of **A X B X C** type. The placements of sample markets were done using the „method of divided parcels”, repeated twice, while the surface of a parcel was of 80 m².

The factors studied:

Factor A Soil tillage system:

a1 classical system (plough + disc 2X)

a2 minimum system (paraplow + rotative harrow)

Factor B Species:

b1 oak

b2 ash tree

Factor C Dimensions measured:

c1 diameter at collet

c2 height

The present paper shows the results obtained after soil exploitation by means of a classical and minimum tillage systems on the dimensional elements of the forestry saplings of oak and ash tree (diameter at the collets and height), measured in the mid-season of vegetation. The systems applied were: classical system (plough + disc 2X) and minimum system (paraplow + rotary harrow).

RESULTS AND DISCUSSION

In order to observe the variance of the dimensional elements of the oak and ash-tree saplings, after the soil preparation in classical and minimum tillage systems, the intensity of growth of saplings will be presented. In order to emphasize the growth vitality, it was taken into consideration the basic elements for this expression: diameter at collets and the height of the sapling. This is the truth criterion regarding the choice of soil tillage system. Each tillage system has an influence more or less significant for the growth of saplings.

The best system will be the one in which the number of works done is smaller, but at the same time, the saplings must have a very active growth. The concrete effects of the soil preparation system were researched by observing the dimensional parameters at the mid-season of vegetation.

In order to observe the influence of the soil preparation system on the quality of saplings, one passed on to the analysis of the growth in diameter at the collets and the height for the following species: oak and ash tree. In table 1 there are the indexes for dissemination which underlined the dispersion rate of the measured growth, while the Figures 1...4 appear in diagram box-plot their variance.

Table 1

Values determined for the indexes of dispersion

Nursery	Species	System	Elements measured	Indexes of dispersion				
				Q0 Min	Q1 25%	Mediana 50%	Q3 75%	Q4 Max
Iarac	Oak	Classical	Diameter at collet, mm	0.40	1.50	2.50	3.00	8.83
			Height, cm	4.80	8.53	10.50	12.00	18.00
		Minimum	Diameter at collet, mm	1.21	2.44	3.43	4.20	6.98
			Height, cm	8.00	18.00	22.00	27.00	39.00
	Ash tree	Classical	Diameter at collet, mm	2.20	5.00	6.00	6.60	9.60
			Height, cm	12.00	21.00	25.00	29.00	39.00
		Minimum	Diameter at collet, mm	2.00	6.20	7.30	8.60	18.00
			Height, cm	18.00	35.00	42.00	51	86.00

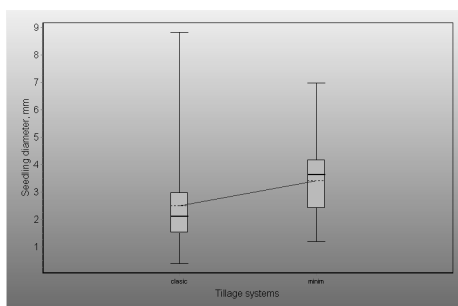


Fig. 1. Variation of the diameter at the ground tissue at oak in the classical and minimal tillage system

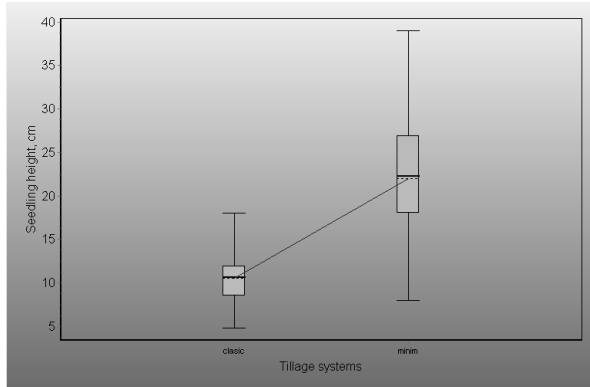


Fig. 2. Variation of the height at oak in the classical and minimal tillage system

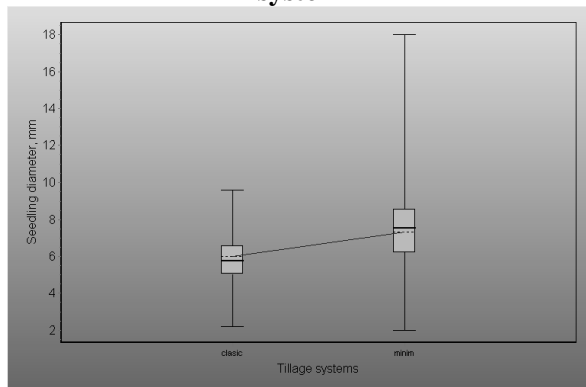


Fig. 3. Variation of the diameter at the ground tissue at ash tree in the classical and minimal tillage system

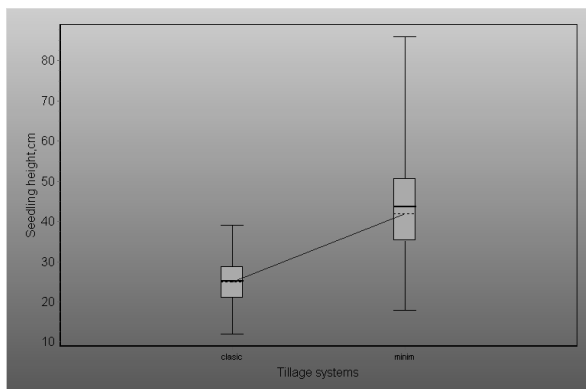


Fig. 4. Variation of the height at ash tree in the classical and minimal tillage system

To synthesize more efficiently the data taken and to be able to describe completely the intrinsic characteristics of the sample, it was chosen a statistic processing with the aid of the program KyPlot. The results obtained are given in table 2 for oak and in table 3 for the ash tree, having as a purpose to underline the variance of the dimensions of saplings (diameter at the collets and height), comparative with the tillage system (minimum/classical systems).

Without insisting too much on the interesting aspects contained as an informational message in the value of the statistical indexes, we noticed though that the height of the oak saplings, as a striking visual element, has an average of 22.25 cm and a maximum value of 39.00 cm, in the case of the tillage system of the soil, compared to the average of 10.64 cm and the maximum value of 18.00 cm in the case of the classical system. Within the same species, there is a significant difference at the level of the diameter at the collets in the following values: classical system 2.12 mm compared to the 3.63 mm at the minimum system.

There can also be noticed the value of the coefficients of variance of the geometric sizes, which range from 26-27% (height) and 42-49% (diameter at collects), which indicates a certain oscillation of groups of multitudes between homogenous and non-homogenous.

At the level of asymmetries, there is a very strict law governing in relation with the two dimensional elements, the experimental distributions are of the right, both for the dimension of the oak saplings obtained in the classical system and those obtained in the minimum tillage system.

Table 2

Statistical indexes regarding the dimension of oak saplings in Iarac nursery

Statistical indicator	Dimensions seedlings			
	Classical system		Minimum system	
	Diameter at collet, mm	Height, cm	Diameter at collet, mm	Height, cm
Mean	2.12	10.64	3.63	22.25
S.E.M. (Average standard error)	0.06	0.15	0.08	0.33
Standard deviation	1.03	2.71	1.52	6.06
Coefficient of variation	0.49	0.26	0.42	0.27
Minimum	0.40	4.80	1.21	8.00
Maximum	8.83	18.00	6.98	39.00
The number of feature values (N)	342	342	342	342
Skewness	1.31	0.21	0.81	0.11
Curtosis	7.75	-0.41	-0.33	-0.51
Mean Deviation	0.81	2.21	1.19	5.00
Median	2.50	10.50	3.43	22.00
Range	8.43	13.20	5.77	31.00
Confidence Level(0,95)	0.11	0.29	0.16	0.64
Lower Confidence Limit	2.07	10.49	3.55	21.92
Upper Confidence Limit	2.18	10.78	3.71	22.58

Even though there is a very strict law governing in relation with the elements measured, the excess of the experimental distributions are, in general, platikurtic for the minimum tillage system, at the two dimensional elements measured and leptokurtic for the diameter at collets in the classical tillage system.

Table 3

Statistical indexes regarding the dimension of ash tree saplings in Iarac nursery

Statistical indicator	Dimensions seedlings			
	Classical system		Classical system	
	Diameter at collet, mm	Height, cm	Diameter at collet, mm	Height, cm
Mean	5.75	25.18	7.53	43.66
S.E.M. (Average standard error)	0.08	0.30	0.11	0.71
Standard deviation	1.35	5.12	1.88	12.18
Coefficient of variation	0.24	0.20	0.25	0.28
Minimum	2.20	12.00	2.00	18.00
Maximum	9.60	39.00	18.00	86.00
The number of feature values (N)	292	292	292	292
Skewness	0.11	-0.07	1.17	0.75
Curtosis	-0.04	-0.39	3.78	0.56
Mean Deviation	1.09	4.20	1.42	9.67
Median	6.00	25.00	7.30	42.00
Range	7.40	27.00	16.00	68.00
Confidence Level(0,95)	0.16	0.59	0.22	1.40
Lower Confidence Limit	5.67	24.88	7.42	42.95
Upper Confidence Limit	5.83	25.48	7.64	44.38

CONCLUSIONS

The most important observations regarding the usage of the soil tillage systems in the forestry nurseries, with direct influences on the growth of the saplings can be synthesized as follows:

1. Technologies modify the physical-chemical and biological properties of the measured soil according with the intensity of the system applied.
2. The system of deep soil dislocations contributed to the aeration of the sub-arable strata, enlarging the permeability for water and the increase of the volume of the root system of the saplings;
3. The aeration works determine reduced and on the short-term modifications, of the soil physics;
4. The system of soil alternation of the working depth determines an improvement in the conditions of development of the saplings and a lot of fuel savings.

5. The unconventional system of soil tillage modifies the physical-chemical properties, which allowed for the listing of its advantages and disadvantages according to the soil type and the culture zone;
6. The values of the dimensional elements (diameter at collets and height) analyzed in both species in the experiment recommend the usage of the minimum tillage system in the case of this nursery.

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