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THE EFFECT OF OPTIMIZING TECHNOLOGICAL PRACTICES ON THE INCREASE OF BIOMASS PRODUCTION AND CARBON SEQUESTRATION RATE TO *PAULOWNIA* SSP.

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Abstract

The research was carried out within an experimental batch with Paulownia elongata, established in 2019 and the fundamental purpose of the experiment was to verify the influence of the different technological links on increasing the biomass production and the carbon sequestration in young Paulownia plants. The research results demonstrated that choosing an optimum plants density of Paulownia plants at the surface unit the plants benefit from an adequate nutrition space and ensure a balanced nutrition by fertirigation during the phases considered critical for the physiological processes of vegetative growth and development, has an direct effect of stimulating the growth and development of the root system of plants and as a result the plants had a good anchoring in the soil, exploring an increasing volume of soil and realizing significantly higher biomass production and also the carbon sequestrated biomass.

Key words: *biomass production, carbon biomass, fertirigation, Paulownia ssp., plants density.*

INTRODUCTION

Originally from China, *Paulownia* ssp. has been used for more than 2500 years as an agroforestry species and in the last 50 years its cultivation has spread to all continents due to its specific characteristics related to its rapid growth rate, high ecological plasticity and its multiple uses. It was brought to Europe around the year 1800, initially as a decorative tree, after which in the last two decades it has been considered as an important commercial source, being considered as a sustainable source of biomass used for energy purposes, the production of hardwood used for the manufacture of an extremely varied range of products is of similar interest (Popescu, A. & Sabau, L., 2016; Jensen, 2016).

The name of the plant originates in Russia, in honor of the daughter of the Tsar Paul I of Russia (Woods, 2008), consort queen Anna Pavlovna, also called "Princess Tree". In ancient Japan it was a plant that was not lacking in the gardens of any family, being considered lucky, being known as the "Phoenix bird tree", due to the power of regeneration after each cut. *Paulownia*, is the solution of the future in forestry, which replaces the beautiful forests of formerly felled mercilessly due to lack, indifference or simply to enrich many. This plant dates to 1049 BC and we find it registered in Asia as a high-quality wood production for the construction of boats and houses (Kircher M., 2022). In China, about 3 million ha have been planted in the last 60 years.

Due to the abusive destruction of forests and the need for timber worldwide, Paulownia is an alternative that offers timber quality in optimum time, starting with 3-4 years for biomass (Abreu et al., 2020; Berdón et al., 2017; Woods, 2008) and 5-10 years for construction wood, which another tree species cannot offer. It absorbs very well the nitrates of the soil and the carbon dioxide in the air (Haldar & Sethi, 2021) offering freshness and tenderness through its appearance and behavior.

Due to its elasticity, it can be planted as a curtain against the wind, the blizzard on the edge of roads, airports, the protection of isolated villages from the open field (withstands over 80 km/h wind speed without breaking).

The research carried out on this "new" woody species, in the last period, had as main purpose, the creation of a clone with the best performance from the point of view of the productive potential, the parental material being quite heterogeneous and being represented only by species pure (Ols & Bontemps, 2021).
Since their initial use, the hybridization between different species has been started and the cloning with the best quantitative and qualitative performances and their official registration has been identified. As mentioned earlier, so far there are several clones available, some of which are more suitable for biomass production, while others are suitable for wood production (Fokina et al., 2020; Tyskiewicz et al., 2019).
The studies carried out so far have demonstrated the existence of a close link between the environmental conditions, the agricultural practices used and the dynamics of growth and development of different *Paulownia* species, with dry biomass production varying from the 2nd year after planting in the range of 1.5-14 t s.u./ha, the effect of agrotechnical and environmental factors also affecting the quality of wood fibers after harvesting the trees (Magar et al., 2018; Sikkema et al. 2021; Jakubowski, 2022; Muthuri et al., 2004; Gyuleva, 2008; Dubova et al., 2019).
Regarding the latter destination, even though the species has a very rapid growth, the harvesting of the stems depends on the type of wood we want to obtain, that is its size at the cubicle. From the different experiments carried out, it has been observed that the currently recommended planting scheme (4.00 m x 4.00 m), is not the one that leads to obtaining a wood of the highest quality: in fact it is known that the growth of the plant biomass is, within certain limits, directly proportional to the space in which the root system develops and the amount of solar radiation that the plant can intercept; and not only that, but also the quality of the wood would be positively influenced by the increase of these parameters (Dobrinoiu et al., 2018).
Other two factors, directly involved in obtaining superior biomass in quantitative and qualitative aspects are: optimal consumption of nutrients (macro and micro-elements) and optimal water consumption. In this context, the present research is also included, for the preparation of which a series of laboratory determinations have been made to establish the degree of influence of the planting scheme and of the fertilization scheme on the biomass production and carbon biomass sequestrated in the species *Paulownia* ssp.
The research on potential ways to reduce CO_2 emissions has demonstrated that the use of Paulownia biomass as a source of renewable energy is a viable alternative, with the constant increase in demand for wood and woody biomass already forecast in Europe until at least 2050 (Kirikkaleli et al., 2022; Hamdan & Houri, 2022; Jamil et al., 2021).

MATERIALS AND METHODS

The experience was of a bi-factorial type, placed in the field according to the method of subdivided plots; the experimental factors considered in the study being the following:
FACTOR A: planting scheme (plant density/ha), with 3 graduations:
- a_1 - Planting scheme 4.00 m x 4.00 m, resulting in a density of 625 plants/ha (Control);
- a_2 - Planting scheme 5.00 m x 5.00 m, resulting in a density of 400 plants/ha;
- a_3 - Planting scheme 6.00 m x 6.00 m, resulting in a density of 277.7 plants/ha.

FACTOR B: fertilization scheme, with 3 graduations:
- b_1 - unfertilized (Control);
- b_2 - fertilized with Polyfeed 14-14-28 + 2MgO + ME - 40 kg/ha;
- b_3 - fertilized with K-Energy Bonus (10-5-38 + 6% S + 3% Mg + B + Mn) - 40 kg/ha.

The experimental variants were placed in three repetitions, so that, following the combination of the two experimental factors, we will have an experience of the type: 3 x 3 = 9 experimental variants.
The analysis and interpretation of the experimental results was performed by the method of analysis of variance, according to the method of subdivided plots.
Each experimental variant, in order to have a constant and significant number of copies for making determinations related to physical and

mechanical properties, has the following dimensions:

a) Planting scheme 4.00 m x 4.00 m: 5 rows x 5 plants (25 plants), with an area of 400.00 m^2;

b) Planting scheme 5.00 m x 5.00 m: 5 rows x 5 plants (25 plants), with an associated area of 625.00 m^2;

c) Planting scheme 6.00 m x 6.00 m: 5 rows x 5 plants (25 plants), with an associated area of 900.00 m^2. The processing of the experimental results and their interpretation was carried out by the variant analysis method, in accordance with the experimental method of dividing the experience into subdivided plots.

Laboratory research methodology:

a) Determination of total biomass. With all the data obtained so far (air and underground biomass), the total biomass of downgraded trees will be calculated. All samples obtained from each tree have been labeled and transferred (Figure 1) to a kiln for drying.

Figure 1. Destructive sampling of Paulownia plants for biomass determination

This oven will operate at a temperature of 85°C for a period of 24 hours to dry the leaves, petioles and branches, and a temperature of 95°C for 48 hours to dry the stems and roots of each tree. After drying, they will be weighed, noting the results. To ensure that the values obtained are the final drying values, they will be placed back on the stove and left for 24 hours (Figure 2).

Figure 2. Separation of plant components and their drying for biomass determination

After 24 hours, they will be weighed again, checking whether the values will be different or not compared to those previously obtained. With these two checks, we ensure that the data obtained is real, and that the moisture losses are not lower than the initial ones because the parts are not sufficiently dry. If there were any differences between the two measurements, they would be left on the other day until the weight is constant. In this way, the dry mass of each of the components in which the trees were previously split is obtained.

b) Determination of underground biomass. To determine the root biomass, it was necessary to manually extract the root system of the plants, because the root system of the dropped trees did not have excessive dimensions.

To avoid damaging the roots of surrounding trees that have not been selected for biomass determination, a 2.00 x 2.00 m protection area around the selected tree will be provided. This square of 4.00 m^2 will be divided into 4 x 1 m^2 areas on each side to analyze the spatial distribution of fine roots around the shaft.

c) Determination of carbon biomass. Biomass carbon is obtained by multiplying total biomass of tree with default value of carbon fraction 0.47 (Eggleston et al., 2006).

RESULTS AND DISCUSSIONS

Results and discussions regarding total biomass production under experimental factors influence.

According to the determinations related to the dynamics of biomass accumulation in the different woods and organs of the *Paulownia* plants after 3 years of vegetation, a great viability is observed regarding both the biomass production achieved at the surface unit, variability that was influenced very much the density of the plants, as well as the fertilization schemes practiced in the experimental field (Tables 1-4).

Thus, the dry biomass production of Paulownia leaves related to the different experimental variants (Table 1) was between 623.93 kg/ha, the lowest biomass production obtained in the case of the control variant (a1b1), variant in which the density of plants it was 625 plants/ha, under non-fertilizing conditions and 1315.06 kg/ha. The highest biomass production was obtained when the density of the plants was 400 plants/ha, plants that were fertilized in during the vegetation period with a dose of 40 kg/ha POLYFEED 14-14-28 + 2MgO + ME (a2b2).

Table 1. Leaves and petioles carbon biomass under experimental factors influence (kg dry matter/ha)

EXPERIMENTAL VARIANT	Leaves (kg/ha)	Difference (kg/ha)	Petioles (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b1 (Control)	623.93	Control	442.93	Control	-	-
a1b2	711.68	87.75	452.78	9.85	x	x
a1b3	661.68	37.75	449.18	6.25	-	-
a2b1	1181.74	557.81	537.36	94.43	xxx	xxx
a2b2	1315.06	691.13	592.91	149.98	xxx	xxx
a2b3	1259.51	635.58	581.80	138.87	xxx	xxx
a3b1	866.21	242.28	474.53	31.60	xx	xx
a3b2	959.65	335.72	490.85	47.92	xx	xx
a3b3	939.65	315.72	484.61	41.68	xx	xx
DL5% = 53.41; DL1% = 213.57; DL0,1% = 337.68 DL5% = 7.13; DL1% = 23.51; DL0,1% = 69.33						

The biomass production of leaf petioles (Table 1) ranged from 442.93 kg/ha (a1b1) to 592.91 kg/ha (a2b2), the experimental variants in which the plant density was 400 plants/ha, in the background of 40 kg/ha fertilizer of the type POLYFEED or BONUS K-ENERGY being the most valuable from the point of view of this biometric parameter.

The branches of Paulownia plants reached a biomass production between 899.28 kg/ha and 1616.34 kg/ha, with very significant positive increases (xxx) compared to the control variant a1b1, registered in the experimental variants a2b1, a2b2, a2b3, a3b2 and a3b3, variants in which the density of the plants was 400 plants/ha and 277.7 plants/ha, respectively. The plants also benefited from the contribution of the nutrients brought after the fertilisation administration of 40 kg/ha of fertiliser (Table 2).

The biomass production of the strains, in year 3 of *Paulownia* plant vegetation, varied within quite wide limits from one experimental variant to another (Table 2), under the influence of the two experimental factors taken into consideration (planting density and fertilization scheme). Thus, under the use of a planting density of 625 plants/ha, the biomass production of the strains was between 1374.18 kg/ha and 1811.68 kg/ha. By reducing the plant density to 400 plants/ha, the production of biomass ranged from 4970.25 kg/ha to 5581.30 kg/ha while, following the use of a planting of 277.7 plants/ha, the biomass values of the strains varied between 2449.25 kg/ha and 2645.09 kg/ha. The highest values of this biometric parameter were obtained in the practice of 5.00 x 5.00 m and 6.00 x 6.00 m planting patterns. This was achieved by managing the fertilisation phase by fertilising the plants with doses of 40 kg/ha POLYFEED or BONUS K-ENERGY.

Compared to the control variant (a1b1), the experimental variants tested within the experimental field recorded production increases between 437.25 kg/ha and 4562.64 kg/ha, which statistically, were significantly positive (x) in the experimental variants a1b2 and a1b3 and very significantly positive (xxx) in the rest of the experimental variants, respectively a2b1, a2b2, a2b3, a3b1, a3b2 and a3b3. The increase of the plant nutrition space and the management of the fertilization representing the essential links in the production of super productions biomass of the stems at the surface unit.

Table 2. Branches and strains biomass production under experimental factors influence (kg dry matter/ha)

EXPERIMENTAL VARIANT	Branches (kg/ha)	Difference (kg/ha)	Strains (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b1 (Control)	899.28	Control	1374.18	Control	-	-
a1b2	1187.26	287.98	1865.43	491.25	xx	x
a1b3	1054.05	154.77	1811.68	437.50	x	x
a2b1	1258.85	359.57	4970.25	3596.07	xxx	xxx
a2b2	1616.34	717.06	5936.82	4562.64	xxx	xxx
a2b3	1585.66	686.38	5581.30	4207.12	xxx	xxx
a3b1	939.71	40.43	2449.25	1075.07	-	xxx
a3b2	1427.49	528.21	2775.65	1401.47	xxx	xxx
a3b3	1238.23	338.95	2645.09	1270.91	xxx	xxx
DL5% = 121.47; DL1% = 234.91; DL0,1% = 316.14 DL5% = 414.03; DL1% = 789.65; DL0,1% = 993.93						

Analyzing the aerial and underground biomass productions of the *Paulownia* plants, very large differences of this biometric indicator were observed (Table 3), the most valuable being the experimental variants in which the plant density was 400 plants/ha, against the background of the necessary supplementation in plant nutrients by administering 40 kg/ha POLYFEED. Thus, the *Paulownia* plants planted at a density of 625 plants/ha produced aerial biomass productions that ranged from 1965.99 kg/ha to 4217.15 kg/ha, in the experimental variants where the plant density was 400 plants/ha, the aerial biomass production ranged from 7948.20 kg/ha to 9461.13 kg/ha, the experimental variants where a planting density of 277.7 plants/ha was practiced, producing aerial biomass production between 4729.70 kg/ha and 5653.64 kg/ha.

The aerial biomass productions of the *Paulowni*a plants registered after 3 years of vegetation increases between 2010.60 kg/ha and 7495.14 kg/ha, production increases that they had, compared to the control variant (a1b1), insignificant statistical assurance (-), in the experimental variant a1b3, significantly positive (x), in the variants a1b2, a3b1 and a3b3, distinctly significant positive (xx), in the case of the a3b2 variant and very significantly positive (xxx), in the experimental variants a2b1, a2b2 and a3b2.

Following the determination of the underground biomass production it was found that as the nutrition space for the *Paulownia* plants increased the highest biomass production being obtained under the conditions of the 5.00 x 5.00 m planting scheme and the administration of 40 kg/ha POLYFEED or BONUS K-ENERGY, for these experimental variants underground biomass productions between 4681.39 kg/ha and 4970.25 kg/ha, followed by the experimental variants in which the planting scheme was practiced 6.00 x 6.00 m, these realizing underground biomass productions that varied between 2831.52 kg/ha and 3044.93 kg/ha.

Table 3. Aerial and underground biomass production under experimental factors influence (kg dry matter/ha)

EXPERIMENTAL VARIANT	Aerial biomass (kg/ha)	Difference (kg/ha)	Underground biomass (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b1 (Control)	1965.99	Control	1292.93	Control	-	-
a1b2	4217.15	2251.16	1730.43	437.50	x	x
a1b3	3976.59	2010.60	1574.18	281.25	-	-
a2b1	7948.20	5982.21	4681.39	3388.46	xxx	xxx
a2b2	9461.13	7495.14	4970.25	3677.32	xxx	xxx
a2b3	9008.27	7042.28	4803.60	3510.67	xxx	xxx
a3b1	4729.70	2763.71	2831.52	1538.59	x	xxx
a3b2	5653.64	3687.65	3044.93	1752.00	xx	xxx
a3b3	5307.58	3341.59	2945.76	1652.83	x	xxx
DL5% = 2146.72; DL1% = 3453.89; DL0,1% = 4912.44 DL5% = 356.97; DL1% = 768.91; DL0,1% = 897.63						

At the opposite pole were located the experimental variants in which the density of the plants was 625 plants/ha, the underground biomass production in their case being between 1292.93 kg/ha and 1730.43 kg/ha, well below the production level of underground biomass obtained for the other experimental variants.

Compared with the control of the experience, the rest of the experimental variants registered production increases ranging between 281.25 kg/ha and 3677.32 kg/ha, the differences regarding the underground biomass productions realized at the surface unit having a statistically insignificant positive assurance (-), in the case of the experimental variant a1b3, significantly positive (x), in the variant a1b2 and very significantly positive in the rest of the experimental variants.

The experimental factors considered in the study had a direct impact on the total biomass production realized by the *Paulownia* plants at the surface unit, productions that recorded values between 3288.92 kg/ha, the minimum value obtained in the case of the control variant (a1b1) and 1443.38 kg/ha, maximum biomass production achieved by the plants belonging to the experimental variant a2b2, variant in which the density of plants was 400 plants/ha, plants that were phased fertilized with 40 kg/ha POLYFEED (Table 4).

Taking a detailed analysis of the behavior of *Paulowni*a plants tested in different planting and fertilization schemes, we observe that, by practicing the 4.00 x 4.00 m planting scheme, biomass production ranged from 3288.92 kg/ha to 5947.58 kg/ha, between 12629.59 kg/ha and 1443.38 kg/ha, when the planting scheme was 5.00 x 5.00 m, respectively between 7561.22 kg/ha and 8698.57 kg/ha following the use of the 6.00 x 6.00 m planting scheme.

Regarding the production increases achieved by the experimental variants compared to the control of the experience, they were significantly positive (x), being between 2291.85 kg/ha and 2688.66 kg/ha, in the experimental variants a1b2 and ab3, respectively very significant positive (xxx), with production differences that varied between 4302.30 kg/ha and 11172.46 kg/ha, in the case of the other experimental variants.

Table 4. Aerial and underground biomass production under experimental factors influence

EXPERIMENTAL VARIANT	Total biomass (kg/ha)	Difference (kg/ha)	Semnificance degrees
a1b1 (Control)	3258.92	Control	-
a1b2	5947.58	2688.66	x
a1b3	5550.77	2291.85	x
a2b1	12629.59	9370.67	xxx
a2b2	14431.38	11172.46	xxx
a2b3	13811.87	10552.95	xxx
a3b1	7561.22	4302.30	xxx
a3b2	8698.57	5439.65	xxx
a3b3	8253.34	4994.42	xxx
DL5% = 2133.58; DL1% = 3349.72; DL0,1% = 4136.99			

Results and discussion regarding total carbon biomass production under experimental factors influence

The biomass of the sequestered carbon in the leaves of the *Paulownia* plants was between 293 kg/ha and 618 kg/ha, the smallest values of this parameter being recorded when using a planting density of 625 plants/ha, followed in ascending order by the variants experimental plants in which a planting density of 277.7 plants/ha was ensured, the highest amounts of organic carbon sequestered in the leaves being determined in the experimental variants where at the establishment of the plantation a plant density of 400 plants/ha was designed, with ice value they ranged from 555.41 kg/ha to 618.07 kg/ha (Table 5).

By making a difference between the experimental variants and the control variant α1b1, it is found that the accumulation of carbon in the leaves intensified with the increase of the surface of the plant foliar apparatus directly influenced by their growth force as the plants benefited from a larger space of nutrition and the optimal provision of the nutrients necessary for plant growth and development, thus eliminating the competition of plants for vegetation factors.

The differences from the experimental control were insignificant (-) in the case of experimental variant a1b3, significantly positive (x), in variant a1b2, distinctly significant positive (xx), in the variants planted according to the scheme 6.00 x 6.00 m (a3b1, a3b2, a3b3) and very significantly positive (xxx), in the experimental variants in which the planting scheme used was 5.00 x 5.00 m.

The leaf petioles sequestered an amount of organic carbon that did not show very large variations from one experimental variant, to another, the carbon biomass being between 208.17 kg/ha and 278.66 kg/ha, with differences from the control variant a1b1, which ranged from 2.94 kg/ha to 70.40 kg/ha, non-significant (-) in variants a1b2 and a1b3, significantly positive (x), in the case of experimental variants a3b1 and a3b3, distinctly significant (xx), in the variant a3b2 and very significantly positive, in the experimental variants a2b1, a2b2 and a2b3, variants in which the leaf petioles have accumulated the highest amount of carbon.

Table 5. Carbon biomass sequestreted into the leaves and petioles under experimental factors influence

EXPERIMENTAL VARIANT	Leaves (kg/ha)	Difference (kg/ha)	Petioles (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b1 (Control)	293.24	Control	208.17	Control	-	-
a1b2	334.48	41.24	212.80	4.63	x	-
a1b3	310.98	17.74	211.11	2.94	-	-
a2b1	555.41	262.17	252.55	44.38	xxx	xxx
a2b2	618.07	324.83	278.66	70.49	xxx	xxx
a2b3	591.96	298.72	273.44	65.27	xxx	xxx
a3b1	407.11	113.87	223.02	14.85	xx	x
a3b2	451.03	157.79	230.69	22.52	xx	xx
a3b3	441.63	148.39	227.76	19.59	xx	x
DL5% = 32.21; DL1% = 113.12; DL0,1% = 189.34 DL5% = 11.19; DL1% = 21.13; DL0,1% = 34.57						

Following the determination of the carbon biomass accumulated in the branches of *Paulownia* plants (Table 6), a significant increase of the values of this parameter was observed, values that varied between 422.66 kg/ha and 558.01 kg/ha, in the plants belonging to the varieties planted according to the 4.00 x 4.00 m scheme, between 441.66 kg/ha and 670.92 kg/ha, in the experimental variants in which the planting scheme was 6.00 x 6.00 m. The maximum quantities of organic carbon sequestered in the branches of the plants being determined in the case of the experimental variants in which the planting scheme used was 5.00 x 5.00 m, against the background of phase fertilization of plants with 40 kg/ha POLYFEED or BONUS K-ENERGY.

In the case of branches, compared to the control variant, the differences related to the amount of carbon sequestrated from the atmosphere varied between 19 kg/ha and 337.01 kg/ha, with statistically insignificant positive assurance (-), in variants a1b3 and a3b1, distinctly significant positive (xx), in the case of variant a3b1 and very significantly positive (xxx), in the rest of the experimental variants.

Table 6. Carbon biomass sequestreted into the branches and strains under experimental factors influence

EXPERIMENTAL VARIANT	Branches (kg/ha)	Difference (kg/ha)	Strains (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b1 (Control)	422.66	Control	645.86	Control	-	-
a1b2	558.01	135.,35	876.75	230.89	xx	-
a1b3	495.40	72.74	851.48	205.73	-	-
a2b1	591.65	168.99	2336.01	1690.15	xxx	xxx
a2b2	759.67	337.01	2790.30	2144.44	xxx	xxx
a2b3	745.26	322.60	2623.21	1977.35	xxx	xxx
a3b1	441.66	19.00	1151.14	505.28	-	xx
a3b2	670.92	248.26	1304.55	658.69	xxx	xxx
a3b3	581.96	159.30	1243.19	597.33	xxx	xxx
DL5% = 116.68; DL1% = 122.13; DL0,1% = 151.13 DL5% = 312.17; DL1% = 443.88; DL0,1% = 562.16						

Analyzing the results regarding the sequestrated carbon biomass in the constituent organs of the *Paulownia* plants, it was demonstrated from the research that the highest amount of organic carbon was retained in the plant strains (Table 6), the carbon biomass in this case showing a strong variability between the 9 experimental variants taken in study. Thus, at the plant density of 625 plants/ha, the biomass of sequestered carbon ranged from 645.86 kg/ha to 876.75 kg/ha, by reducing the plant density to 400 plants/ha, the carbon biomass varied between 2336.01 kg/ha and 2790.30 kg/ha while at a density of 277.7 kg/ha the carbon biomass was between 1151.14 kg/ha and 1304.55 kg/ha.

The differences registered in this parameter, compared to the control of the experience (a1b1), were insignificant (-), in the experimental variants a1b2 and a1b3, distinctly significant positive (xx), the variant a3b1 and very significantly positive, in the rest of the experimental variants analyzed.

The total aerial biomass of the sequestered carbon recorded values between 924.01 kg/ha and 4446.73 kg/ha, the plants tested under the conditions ensuring a planting density of 400 plants/ha and fertilized at doses of 40 kg/ha fertilized totally soluble and fully assailable to plants by fixing the highest amounts of organic carbon (Table 7). Differences from the control variant ranged from 944.98 kg/ha to 3522.72 kg/ha, with statistically insignificant positive assurance (-) for experimental variants a1b2 and a1b3, distinctly positive (xx), for variants a3b1 and a3b3 and very significant positive (xxx), in experimental variants a2b1, a2b2, a2b3 and a3b2.

Table 7. Total aerial and underground carbon biomass sequestreted under experimental factors influence

EXPERIMENTAL VARIANT	Aerial biomass (kg/ha)	Difference (kg/ha)	Underground biomass (kg/ha)	Difference (kg/ha)	Semnificance degrees	Semnificance degrees
a1b2	1982.06	1058.05	813.30	205.63	-	x
a1b3	1868.99	944.98	739.86	132.19	-	-
a2b1	3735.65	2811.64	2200.25	1592.58	xxx	xxx
a2b2	4446.73	3522.72	2336.01	1728.34	xxx	xxx
a2b3	4233.88	3309.87	2257.69	1650.02	xxx	xxx
a3b1	2222.95	1298.94	1330.81	723.14	xx	xx
a3b2	2657.21	1733.20	1431.11	823.44	xxx	xx
a3b3	2494.56	1570.55	1384.50	776.83	xx	xx
DL5% = 1136.82; DL1% = 1245.91; DL0,1% = 1617.83; DL5% = 186.23; DL1% = 477.71; DL0,1% = 1184.95						

The carbon biomass resulting from the analysis of the root system of plants was between the limits of 607.67 kg/ha and 813.30 kg/ha, by practicing the planting scheme of 4.00 x 4.00 m, between the limits of 1330.81 kg/ha and 1431.11 kg/ha, when using the planting scheme of 6.00 x 6.00 m, the most valuable being the plants harvested from the experimental variants in which the planting scheme was 5.00 x 5.00 m, these having a well-developed root system, with great capacity to explore a volume high soil and thus fixing a large amount of organic carbon (Table 7).

Compared with the control variant (a1b1) in which the carbon biomass was 607.67 kg/ha, the rest of the experimental variants recorded differences from insignificantly positive (-), to variant a1b3, significantly positive (x), to a1b2, distinctly significant positive (xx), in the experimental variants a3b1, a3b2 and a3b3, up to very significant positive (xxx) in the experimental variants a2b1, a2b2 and a2b3.

Table 8. Total carbon biomass sequestrated under experimental factors influence

EXPERIMENTAL VARIANT	Total biomass (kg/ha)	Difference (kg/ha)	Semnificance degrees
a1b1 (Control)	1531.69	Control	-
a1b2	2795.36	1263.67	x
a1b3	2608.86	1077.17	-
a2b1	5935.90	4404.21	xxx
a2b2	6782.74	5251.05	xxx
a2b3	6491.57	4959.88	xxx
a3b1	3553.77	2022.08	x
a3b2	4088.32	2556.63	xxx
a3b3	3879.06	2347.37	xx
DL5% = 1163.18; DL1% = 2331.12; DL0,1% = 2471.91			

Compared to the control variant (a1b1), in the other 8 experimental variants (Table 8), there were registered increases in the total biomass of carbon sequestered by the plants, increases that had a statistically insignificant positive assurance (-), in variant a1b3, significantly positive (x), in experimental variants a1b2 and a3b1, distinctly significant positive (xx), in the case of variant a3b3 and very significantly positive (xxx), in experimental variants a2b1, a2b2, a2b3 and a3b2, variants in which the *Paulownia* plants were characterized by increased capacity for assimilation and fixation of organic carbon in the atmosphere.

CONCLUSIONS

Overall, it is observed that the biomass production of the leaves increased directly in proportion to the increase of the nutrition space related to the plants, but also with the dose of fertilizer administered to them during the vegetation period.

Thus, the biomass production of the petioles showed increases compared to the control of the experience with the same statistical assurance as with the biomass of the leaves, there being a direct correlation between the two components of the leaf, respectively between the tongue and their petiole.

The biomass production of the branches increased directly in proportion to increasing the distance between plants and the dose of fertilizer administered to the plants by fertilization during their vegetation period, the highest values of this biometric parameter being obtained by practicing the two 5.00 x 5.00 m, respectively 6.00 x 6.00 m planting schemes.

The biomass of the stems was directly influenced by the density of the plants at the surface unit and by the administration of the phase fertilization of the *Paulownia* plants, at the planting density of 400 plants/ha, respectively 277.7 plants/ha, the production increases exceeding the control production with over 1075.07 kg/ha.

By ensuring a planting density of 400 kg/ha and ensuring a balanced nutrition with macro and micro-elements essential for the growth and harmonious development of *Paulowni*a plants, superior aerial biomass production was achieved, with very significant production increases of between 5982.21 kg/ha and 7495.14 kg/ha.

The administration of POLYFEED type fertilizers at a dose of 40 kg/ha and ensuring optimum planting density significantly influenced the total biomass production of *Paulownia* plants, benefiting from both a balanced intake of nutrients and a proper nutrition station, factors that stimulated the physiological processes of plant growth and development in good conditions, which led to the recording of significantly higher total biomass production increases, while also increasing the value of biomass as a raw material in the wood industry.

Carbon biomass sequestered in the leaves of 3-year-old *Paulownia* plants, recorded the lowest value in terms of planting density of 625 plants/ha, in conditions of non-fertilization of plants, biomass that increased with the reduction of plant density to surface unit and with additional administration of nutrients by fertilizing plants with fertilizer doses of 40 kg/ha.

The highest amount of sequestered carbon in the *Paulownia* plant branches (759.67 kg/ha) was determined under the conditions of using an optimum density of 400 plants/ha and administering during the vegetation period of plants 40 kg/ha POLYFEED.

Carbon biomass sequestered in the stems of *Paulownia* plants, after 3 periods of their vegetation, reached maximum values when at planting a density of 400 plants/ha was provided, against the background of supplementing the necessary nutrients by phasing the plants with 40 kg/ha POLYFEED.

Of the planting schemes, respectively the fertilization schemes, tested in the experience with *Paulownia*, the most effective in terms of the ability of plants to sequester organic carbon from the atmosphere and to achieve higher values of carbon biomass has proved to be the planting scheme that it provided a density of 400 plants/ha, against the background of fertilizing plants with doses of 40 kg/ha POLYFEED, respectively 40 kg/ha BONUS K-ENERGY.

Under the conditions of planting density of 277.7 plants/ha, the total carbon biomass increased significantly, compared with the values obtained in the variants where the plant density was maximum (625 plants/ha) whereas, compared with the experimental variants where the number of plants per unit area was 400 plants/ha, there was a decrease in the ability of plants to assimilate organic carbon from the atmosphere, which gives us the possibility that the greatest impact on the dynamics of carbon sequestration in particular.

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