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STUDY ON THE ADAPTABILITY OF GIANT BAMBOO UNDER SOIL-CLIMATIC CONDITIONS SPECIFIC TO ROMANIA

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Abstract

Giant bamboo, acknowledged as a specific culture of China than Europe, was introduced in Romania by the Italian Consortium of Bamboo, Only Moso International, in order to popularize this plant among farmers in the EU. Cultivated at this time only for decorative purposes, bamboo is a real industry in Asia, where it is recovered almost entirely: trunk, root, rhizome, the leaves and buds are really hunted for Asian restaurants.
Year 2014 represented the debut year in the cultivation of bamboo in Europe, with the first plantation in Italy, where currently there are 1.400 hectares planted.
Phyllostachy pubescens specie is a giant perennial graminaceae, ages 80-100 years and height of stems from 14 to 25 meters, with a diameter of 8 to 15 cm. It can adapt easily in temperate climates, provided precisely to achieve specific technological link, this plant can resist in areas where winter minimum temperatures do not fall below -25°C.
In Romania, giant bamboo get interest already for many farmers, especially those of researchers within the UASVM Bucharest, where he founded an experimental plantation in order to test the adaptability of species to the specific soil-climatic conditions.
As a result of the observations and determinations made on giant bamboo plants in various stages of vegetation, we can say with certainty that that specie has adapted surprisingly well to conditions specific to Romania, successfully resisting the extreme lows that have exceeded the values of -23°C, recorded during winter 2016.
In these conditions, the cultivation of giant bamboo may represent a new opportunity for Romanian agriculture and at the same time a new paradigm for business.

Key words: *giant bamboo, rhizomes, sprouts, eco-friendly, vegetarians, investment.*

INTRODUCTION

Bamboo wood is an excellent raw material for a wide range of products, its multiple and varied uses, from this plant being valorized all vegetative organs: bamboo shoots, highly appreciated due to its nutritional value and which have multiple uses in cosmetics, bamboo and wood can be used to heat homes or as constructive material (Bello and Espilo, 1995; Dransfield and Widjaja (eds.), 1995).
Bamboo can be drawn and can also be used for fiber and clothing as well as for the manufacture of beverages.
While a commercial plantation of wood needs 20-30 years to produce high-quality timber, a bamboo plantation timber provides clearly superior quality in a much shorter period of time, without such an effort and can produce between 50 and 70 tons of wood per year.
Bamboo not only has many uses in terms of capitalizing on the timbers, buds and Rhizome, but this plant brings many benefits to the environment by reducing emissions of greenhouse gases, generating an annual significant quantity of oxygen.
Among more than 1.200 species and 80 genera of bamboo grown in China, there has been selected the species *Phyllostachys pubescens* due to its qualitative characteristics, productive, and his plasticity (Gonzales and Umali, 1995), the latter making possible the cultivation ways in various soil-climatic zones without the risk of damaging the culture.
Development and implementation of cultivation technologies for giant bamboo through a sustainable management and the use

of raw materials resources derived from this species, can stimulate economic development in rural areas, with the foundations for the growth of living standards in deprived communities, through the creation of new jobs in rural and suburban areas.

MATERIAL AND METHOD

In pursuing the degree of its adaptability to the soil-climatic conditions specific to Romania, an experiment was mounted within the Experimental Teaching and the University of Agronomical Sciences and Veterinary Medicine of Bucharest, during which comments were made and biometric measurements concerning the growth and morphological development of bamboo plants belonging to the species *Phyllostachys pubescens*.

Culture was established in April 2016 by planting seedlings in rows at An equidistant area of 2.88 m, thus ensuring a culture density of 1.200 plants/ha.

Before running the basic soil (plough), was conducted on the base of soil fertilization, using for this purpose the manure well fermented, EC was administered at a dose of 20 tonnes/ha, by uniform soil surface scattering and subsequent incorporation with making the plough .

Technological itinerary began carrying out the work of tilling to a depth of 25-30 cm, followed by disking with a paper GD 3,2, at 10-12 cm deep, perpendicular to the direction of the plough.

Upon completion of the disking work followed by picketing the land operation, operation that aimed to determine the place which they will handle future giant bamboo plants.

For the purpose of planting seedlings were dug holes for planting, the sizes of 20/20 cm, work that was carried out in the growing day.

After planting was mounted drip irrigation system, which is absolutely necessary, at least during the first 2 years after planting knew that this species is susceptible to hydric deficit in the early years after planting, when the root system is not sufficiently well developed, the plant not being well anchored in the soil, so as to be able to take over from reserve of soil total amount of water it needs.

An important work carried out immediately after planting was the land humectation, mulch layer being made of chopped wheat straw the size of 10 cm, which are placed on the rows of plants, in a thick layer of 15 cm. Through the operation of soil humectation was achieved both weed whose growth was inhibited but keeping the ground water reserve due to avoid rapid evaporation at the surface of the soil.

The humectation operation of the soil had a direct impact on the growth of bamboo plants resistance to hydric stress conditions, encountered frequently in Romania, especially in the months of July-August.

Throughout the growing season of the crop were carried out observations and biometrical measurements plants morphological development, during which the number of stems on the plant, the number of parent shoots trained during the whole period of vegetation, their height, diameter of stems and the degree of branching.

Experimental results obtained were centralized in synthetic tables, analysed and interpreted in terms of dynamic analysis method, during which the degree of adaptability of the species in condition soil-climatic conditions specific to the Romanian Plain.

RESULTS AND DISCUSSION

Analyzing the number of stems formed on the parent plant, we note that this biometric parameter recorded average values between 7 and 19 stems/plant, number of stems per plant growing parent formats with advancing plant vegetation of giant bamboo.

Thus, if at the time of planting seedlings number of stems on the plant was 7 stems/plant, calculations performed after 3 months from the moment of planting have highlighted the fact that their number has increased, reaching 11 stems/plant.

With the advancement in the growing season, plants showed a strong capacity for differentiation of main stems, the average number of stems formed reaching 15 stems/plant, 6 months at the time of planting, 18 stems/plant, after 9 months of planting, in the early spring, the average values of this parameter have been 19 stems/plant.

This phenomenon can be put on genetic species which once rooted manifests a fantastic capacity of differentiation of new stems, but a pace emphasized growth and development.
Note so that the process of differentiation and growth of principal stems and continued as long as during low temperatures were recorded so that, in the interval between the entrance and the exit of winter was more differentiated average 1 stem/plant.
We can thus conclude that the plant continues its morphological processes as long as temperatures remain positive though low, however.

Table 1. Number of stems per plant and height of stems

TIME OF DETERMINATIONS	STEMS/PLANT		DIF. (No.)	HIGH OF STEMS		DIF.
	(No.)	(%)		(cm)	(%)	(cm)
Time of planting (Control)	**7**	**100.0**	**Control**	**27.3**	**100.0**	**Control**
3 months after planting	11	157.1	4.0	45.4	166.3	18.1
6 months after planting	15	214.3	8.0	46.8	171.4	19.5
9 months after planting	18	257.1	11.0	59.6	218.3	32.3
12 months after planting	19	271.4	12.0	68.3	250.2	41.0

Average height of stems present on parent plant has been an upward curve, this biometric indicator recording averages of 27.3 cm at the time of planting, 45.5 cm, at 3 months after planting, 46.8 cm, at 6 months of vegetation, 59.6 cm at 9 months after planting, maximum heights of stems being recorded at the conclusion of a cycle it's vegetation, respectively at 12 months after the time of planting. It can be seen that, as bamboo plants is advancing, isolates had an accelerated growth rate, increasing their height by more than 10 cm per month, the differences recorded versus time of planting, took control of the experience, being covered by 18.1 and 41.0 cm.

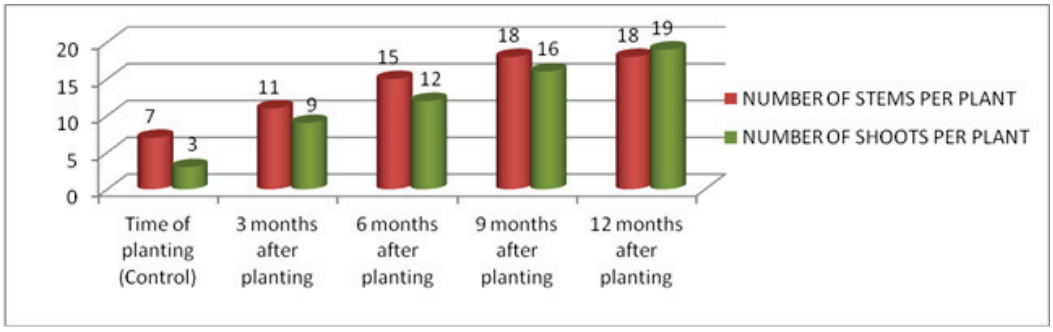

Figure 1. Number of stems and shoots per plant

We can thus conclude that with the parent plant, rootedness the root system develops powerful herb lashed into the ground very well and are thus able to explore an increasingly large volume higher than the ground, so that the plants are able to extract nutrients essential for differentiation of stems and their growth and development.

The root system of bamboo plants represented by the rhizomes (underground stems), which penetrate into the soil up to a depth of 40 cm, and monopodial growing characteristics of the species due to increased branching, the species ability to give rise to new shoots, respectively new plants forming their own roots and differencing its self being able to synthesize single feed (Ramoran et al., 1993).

Table 2. Number of the shoots per plant and height of the shoots

TIME OF DETERMINATIONS	SHOOTS/PLANT		DIF.	HIGH OF SHOOTS		DIF.
	(No.)	(%)	(No.)	(cm)	(%)	(cm)
Time of planting (Control)	**3**	**100.0**	**Control**	**7.4**	**100.0**	**Control**
3 months after planting	9	300.0	6.0	35.6	481.1	28.2
6 months after planting	12	400.0	9.0	50.9	687.8	36.0
9 months after planting	16	533.3	13.0	52.3	706.8	44.9
12 months after planting	19	633.3	16.0	67.0	905.4	59.6

Trained in these shoots during the period of vegetation in turn recorded accelerated growths, their stems growing in height with a few cm per day.

Analyzing the number and height of shoots mother plants trained on during the period of vegetation is observed that the two biometric parameters recorded a upward curve, with the advancement in bamboo plant vegetation.

Thus, if at the time of planting were present on the parent plants, on average 3 shoots/plant, after the 3 months from the moment of planting their number has tripled, reaching 9 shoots/plant, arriving after a cycle of vegetation at 19 shoots/plant, which once again confirms the strong offspring capacity of this species.

The results are spectacular when considering the average height of shoots in various pheno-stages of vegetation.

Note so that if you are making a comparison with the control group (planting) when trained on the mother plant shoots have reached heights of 7.4 cm environments, subsequently increases are becoming more intense, 35.6 cm respectively in 3 months from the moment of planting, 50.9 cm at 6 months, 9 months 52.3 cm and 67.0 cm 12 months after planting These offshoots reaching and even exceeding the present values of main stems on the plants.

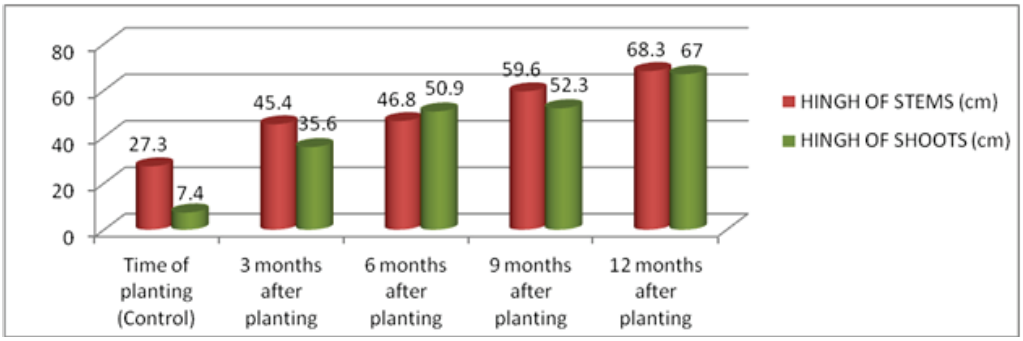

Figure 2. High of stems and shoots

In the first year of vegetation, the diameter of the main stems present on the parental plants has been recorded values between 0.1 and 0.3 mm, minimum values being recorded at the time of planting (version control), and highs after 9 and 12 month block area at the time of the establishment of the plantation.

Analyzing the average number of branches formed on the parental plant, it becomes apparent that if at the time of planting were differentiated 2 branchers/plant, after 3 months from the time of planting, their number has risen to 5, after 6 months number of branches differentiated per plant was 6, and when temperatures decreasing, plants have slowed the pace of growth, the number of branchers present on the parental plants was 6.5 branchers/plant.

Table 3. Diameter of stems and branches on the stem

TIME OF DETERMINATIONS	STEMS DIAMETER		DIF.	BRANCHERS PER STEM		DIF.
	(mm)	(%)	(mm)	(No.)	(%)	(No.)
Time of planting (Control)	**0.1**	**100.0**	**Control**	**2.0**	**100.0**	**Control**
3 months after planting	0.2	200.0	0.1	5.0	250.0	3.0
6 months after planting	0.2	200.0	0.1	6.0	300.0	4.0
9 months after planting	0.3	300.0	0.2	6.5	325.0	4.5
12 months after planting	0.3	300.0	0.2	6.5	325.0	4.5

The diameter of the shoots had registered lower values compared to the diameter of the main stems, this indicator having values between 0.1 and 0.2 mm, maximum values being recorded after 9 and 12 months from the time of planting.

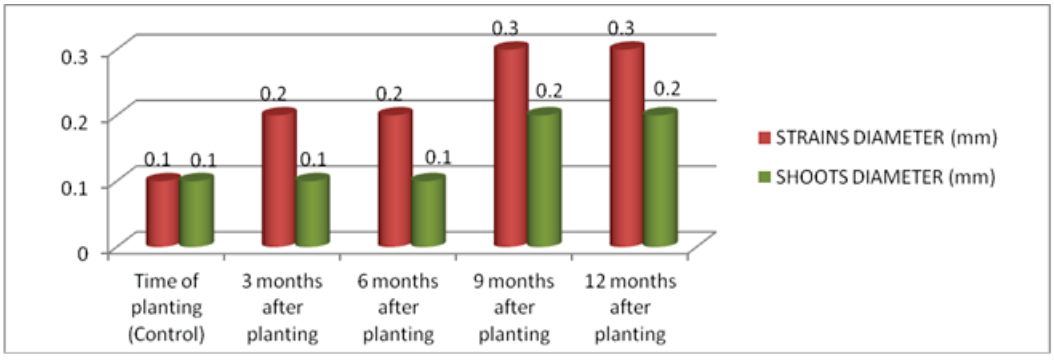

Figure 3. Diameter of stems and shoots

Table 4. Diameter of shoots and branches on the shoot

TIME OF DETERMINATIONS	SHOOTS DIAMETER		DIF.	BRANCHERS PER SHOOT		DIF.
	(mm)	(%)	(mm)	(No.)	(%)	(No.)
Time of planting (Control)	**0.1**	**100.0**	**Control**	**1.5**	**100.0**	**Control**
3 months after planting	0.1	100.0	0.0	5.5	366.7	4.0
6 months after planting	0.1	100.0	0.0	6.0	400,0	4.5
9 months after planting	0.2	200.0	0.1	6.5	433.3	5.0
12 months after planting	0.2	200.0	0.1	8.0	533.3	6.5

In terms of the number of branches formed during the period of vegetation on the young shoots bands during the same period, notes that this biometric parameter recorded values between 1.5 and 8.0 branchers/shoot, this issue highlights once again the differentiation of secondary branching out and the strongly growth of that specie.

Based on the observations and determinations carried out we can say with certainty not to err, that specie *Phyllostachys pubescens* has been successfully adapted to the soil and climate conditions specific to Romania, despite to the extreme minimum temperatures over -23^{o}C, recorded in the winter of 2016 and may represent a new opportunity for farmers in the context of a sustainable rural development.

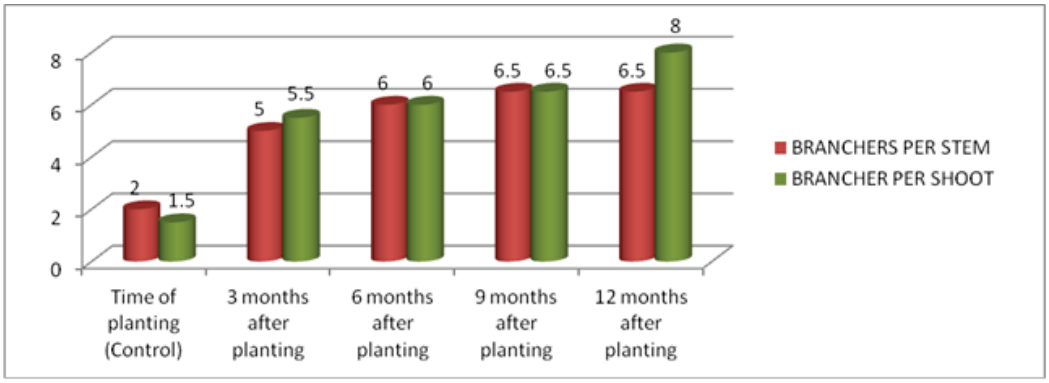

Figure 4. Number of branchers per stem and shoot

CONCLUSIONS

Bamboo giant leverages very well degraded land, considered unsuitable for other species of crop cultivation.

Increase and developing very well, provided the optimum planting times (early spring, March-April).

Mulching of the soil provide resistance in the hydric stress conditions, thus avoiding loss of water as a result of evaporation from soil surface thereof.

Does not require additional maintenance works apart from irrigation and weed control, just in the first years after planting.

Do not submit specific pests and diseases, as a result unnecessary expenditure on plant-protection products to combat them.

After installing culture in the field (rooting) species has large capacity for diseases, starting from the shoots nodes present on the underground stems (rhizomes).

It can be a successful business for farmers in the area of soil-climatic from Romania, provided to ensure water demand, especially in the first two years after plantation establishment

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