

THE CO₂ INFLUENCE ON THE GROWTH OF THUJA OCCIDENTALIS FILICOIDES PLANTS

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Abstract

This paper presents an experimental regarding the influence of CO₂ on the growth of Thuja occidentalis Filicoides plants. Increasing the CO₂ content in solariums, from 0.07% to 0.1% has a result in increasing the growth rate.

Key words: CO₂ administration, growth rate, circumference of the stem, economical efficiency.

INTRODUCTION

The experience made in Leș nursery (Oradea) with CO₂ administration in solarium, influenced favorable the growth potential of the Thuja occidentalis Filicoides plants.

It is known that in outdoor the air contains 0.03% of CO₂ can decrease so much that can slow and even stop the plant assimilation.

The supplementation of CO₂ is a way to improve the growing potential of the plants.

Increasing the CO₂ content in solariums, from 0.07% to 0.1% has a result in increasing the growth rate, only when the conditions of temperature, light, water and soil are proper.

MATERIAL AND METHOD

In this experiments were used Thuja occidentalis Filicoides plants. The plant is very valuable through his decorative effect, has slow growing, 4-5 m high [1]. Is not very often in our country because of the absence of the plant material as a result of the slow growing and the low rate of multiplication.

The experiment had two variants:

V1 - control

V2 - CO₂ treatment

Each variant was 100m² and 40 plants of Thuja occidentalis Filicoides. The planting was made in the middle of the April, in containers. After the planting the temperature was 16-18°C by day and 11-14°C by night, for 1 week, and in rest 20-21°C by day and 16-18°C by night.

In the air the humidity was 60-70% and in soil 70-75%.

The irrigation was made on drop and in June by aspersion.

The fertilization was made only by laboratory tests.

The CO₂ administration begun 1 hour after sun rising and stopped 2 hours before the set. 1 liter of CO₂, on pressure of 1 atm. and temperature of 20°C, has 2 grams weight. To obtain 0.1% CO₂ concentration in the air, where used 6 grams of CO₂/hour/100 m³.

The uniform assessment of CO₂ was made by using polietilen tubs, 30 m length, penetrated on each meter.

The CO₂ was administrated between 1th of April and 10 of September, every year in period 2009-2011.

There were measured the follows characteristics of the plants: the high of the growth, the circumference of the stem and of the crown and it was estimate the economical efficiency of every variant.

RESULTS

Comparing the plants growth in 2009 it is shown that the high of the stem is 9 cm higher on the plants of Variant 2, with very distinct meaningful difference as the control. The difference is the result of high content of CO₂ (0.1%) in the solarium of V2 plants. (table 1)

Table 1

The growth of Thuja occidentalis Filicoides plants cultivated in experimental culture in 2009

Variants	Plants growth		±D	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	26	100	-	-
V2 - CO ₂ treatment	39	150	13	xxx

DL 5% - 3,4

DL 1% - 5,4

DL 0.1% - 8.7

In 2011 too, the high of the plants was 43% bigger on Variant 2, as Variant 1, (table 2), the difference was very distinct meaningful.

Table 2

The growth of *Thuja occidentalis* Filicoides plants in 2011

Variants	Plants growth		$\pm D$	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	69	100	-	-
V2 - CO ₂ treatment	99	143	30	xxx

DL 5% - 4,8

DL 1% - 8,6

DL 0.1% - 15,6

Looking on the girth of the crown of *Thuja occidentalis* Filicoides plants in 2009 we can see that it is with 27% bigger on Variant 2, with CO₂ treatment, as Variant 1, the control, with distinct meaningful difference. (table 3)

Table 3

The girth of the crown of *Thuja occidentalis* Filicoides plants in 2009

Variants	Girth of the crown		$\pm D$	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	29	100	-	-
V2 - CO ₂ treatment	37	127	8	xxx

DL 5% - 3,1

DL 1% - 5,0

DL 0.1% - 8,1

In the last year of the experiment, 2011, the girth of the crown was bigger on the variant with the plants which benefited of a higher percent of CO₂ in atmosphere, with very distinct meaningful difference as the control. (table 4)

Table 4

The girth of the crown of *Thuja occidentalis* Filicoides plants in 2011

Variants	Girth of the crown		+ - D	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	55	100	-	-
V2 - CO ₂ treatment	76	138	21	xxx

DL 5% - 5,9

DL 1% - 10.6

DL 0.1% - 19,2

Concerning the circumference of the stem on *Thuja occidentalis* Filicoides plants in 2009 this was bigger on Variant 2, with 43%, as Variant 1, the control, with very distinct meaningful difference.

Table 5

The circumference of the stem on *Thuja occidentalis* Filicoides plants in 2009

Variants	Circumference of the stem		±D	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	1,6	100	-	-
V2 - CO ₂ treatment	2,3	143	0,7	xxx

DL 5% - 0,30

DL 1% - 0,46

DL 0.1% - 0,69

In 2011, the last year of the research, the circumference of the stem on *Thuja occidentalis* Filicoides plants, was bigger on Variant 2, as Variant 1, the control. (table 6)

Table 6

The circumference of the stem on *Thuja occidentalis* Filicoides plants in 2011

Variants	Circumference of the stem		+ - D	The meaning of the difference
	Absolute (cm)	Relative (cm)		
V1 - control	7,6	100	-	-
V2 - CO ₂ treatment	9,2	121	1,6	xxx

DL 5% - 0,5

DL 1% - 0,8

DL 0.1% - 1,4

Looking to expenses, to the value of the entire production and to the profit level we can define the economical efficiency of every variant.

Table 7

Economical efficiency

Variants	The high of the plants (cm)	Expenses (lei/ha)	Average price (lei/pcs)	Production (pcs/ha)	The value of the production (lei/ha)	Profit (lei/ha)	The rate of the profit (%)
V1 - control	69	315.200	34,5	20000	690.000	374.800	118,9
V2 - CO ₂ treatment	99	427.900	49,5	20000	990.000	562.100	131,3

The highest profit was on Variant 2, *Thuja occidentalis* Filicoides plants treated with CO₂ with the highest rate of the profit (131,3%).

CONCLUSIONS

1. Growing of *Thuja occidentalis* Filicoides plants , a very valuable plant through his decorative effect, is a profitable activity depending by the way of growing.
2. In solariums the concentration of CO₂ can decrease so much that can slow and even stop the plant assimilation.
3. Increasing the CO₂ content has a result in increasing the potential of the growth of *Thuja occidentalis* Filicoides plants.
4. Increasing the CO₂ content in solariums, from 0.07% to 0.1% has a result in increasing the growth rate (28-50%), by only when the conditions of temperature, light, water and soil are proper.

5. The CO₂ administration begun 1 hour after sun rising and stopped 2 hours before sun set.
6. 1 liter of CO₂, on pressure of 1 atm. and temperature of 20°C, has 2 grams weight.
7. To obtain 0.1% CO₂ concentration in the air, where used 6 grams of CO₂/hour/mp.
8. The uniform assessment of CO₂ was made by using polietilen tubs, 30 m length, penetrated on eachmeter.
9. The CO₂ was administrated between 1th of April and 10 of September, every year in period 2009 - 2011.
10. The expenses generated by CO₂ administration are recovered and more, ensure a net profit of 562.100 lei/ha.

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