NUTRITIVE ELEMENTS DYNAMICS IN ACIDIFYING SUBSTRATE ON *CHAMAECYPARIS* sp. CULTURE

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One of the problems that occur in the planting material technology is the pH value of substrates. The dendrology plants present different needs for the pH values especially for the acid pH. The aim of the research followed up the pH correcting and the behavior of some substrate after sulphur application. The experiment was made by the Agrochemistry department as subject of a Romanian Academy project.

Key words: Acidifying substrate; Nutritive elements dynamics; *Chamaecyparis* sp.

INTRODUCTION

The economic development of our country and houses building determined in the last years the development of the dendrology sector especially the obtaining of planting material for the gardens. The obtaining of planting material in containers present some technological problems that needs research regarding some culture substrates with special agrochemical characteristics.[1]

One of the problems that occur in the planting material technology is the pH value of substrates. The dendrology plants present different needs for the pH values especially for the acid pH.[2, 3]

The aim of the research followed up the pH correcting and the behavior of some substrate after sulphur application. The culture substrates were made of different waste materials such as: forestry compost and leaves compost. The *Chamaecyparis* sp. plants were cultivated on these substrates. The control variant substrate was made of fallow soil, manure and sand in volumetric ratio 2:2:1. The sulphur in dose of 3 g/L was used for the pH correcting and was added in the containers with growing plants. The agrochemical characteristics were determined and at the end of theexperiment the dry matter content and the nitrogen, phosphorus and potassium total form content were determined in the *Chamaecyparis* sp. plants[4, 5].

MATERIALS AND METHODS

The research made in the year 2006 followed to establish one of the culture substrate receipt on which the plants of *Chamaecyparis* sp. will register the biggest growing.

Four substrates were studied made of different organic waste materials. The aim of studies was to obtain same substrate with physical characteristics (the granulometric composition, porosity, aeration and hydric conditions) that can be optimum for the plants cultivated in containers.

The control variant was the substrate made of fallow soil, manure and sand in volumetric ratio of 2:2:1.

During the experiment, pH was modified with sulphur applied in containers with plants. The dose was 3g S/L. During the vegetation period the agrochemical characteristics were determined and it was determined the pH evolution[6].

Table 1

Substrate variants and their agrochemical chracteristics at the beginning of the experiment

No.	Variant	Ratio	pH	N (NH_4+NO_3) ppm	P-PO_4 ppm	K ppm
1	Fallow soil+manure+sand	2:2:1	7.75	49.25	15.8	260
2	Peat+sand	4:1	5.26	18.50	4.85	35
3	Forestry compost+sand	4:1	6.88	9.75	2.20	85
4	Leaves compost+sand	4:1	7.59	2.25	21.20	160
5	Forestry compost+leaves compost+sand	2:2:1	7.47	10.75	28.6	130

RESULTS AND DISCUSSIONS

At the beginning of the vegetation period in the substrates, pH varied between 5.26 in variant 2 (peat + sand) and 7.75 in control variant. The nitrogen content varied in all variants, but the variants 3 and 4 were characterized by a low content and the control and variant 2 by a medium content.

The phosphorus content was very low in variant 2 (peat and sand) and variant 3 (forestry compost + sand) and medium in variant 4 and 5.

After the sulphur application the pH and the agrochemical characteristic had different variation function of substrate type. In the control variant (fallow soil + manure + sand) the pH decreased more to the 3.63 in the 14th day. At the end of vegetation period the pH values increased to the 6.21 because of the buffering capacity –the soil property to oppose of tendency that can modify the soil pH.

The ammonium and nitrates content increased till the 10th day and mean time the substrates pH values decreased. At the end of experiment the nitrogen content in the control variant was low (10.43) and the pH increased to 6.21.

The phosphorus mobility was influenced by the pH and in the first 3 days it decreased to the 0.36 ppm, after that the pH was acid and the content of soluble phosphorus increased to the 75.18 ppm at the end of experiment. At the beginning of experiment the potassium content was very high (260 ppm) and after the decrease of pH the potassium content was constant between 50–70 ppm (Fig. 1).

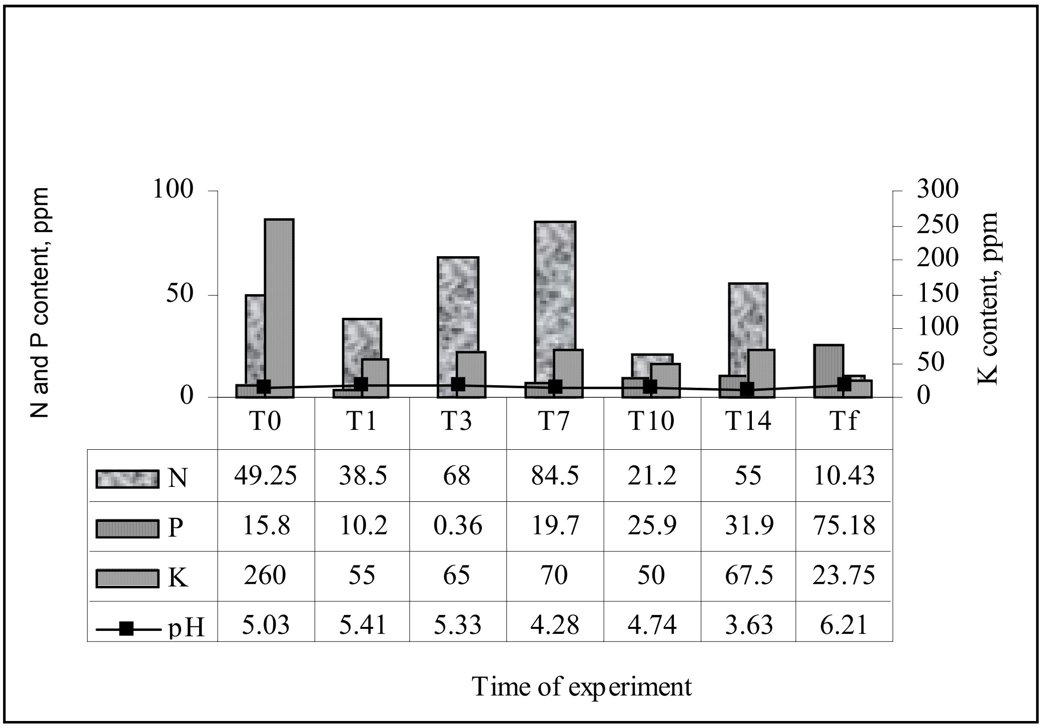


Fig.1. The pH and nutritive elements variation in variant 1 (control).

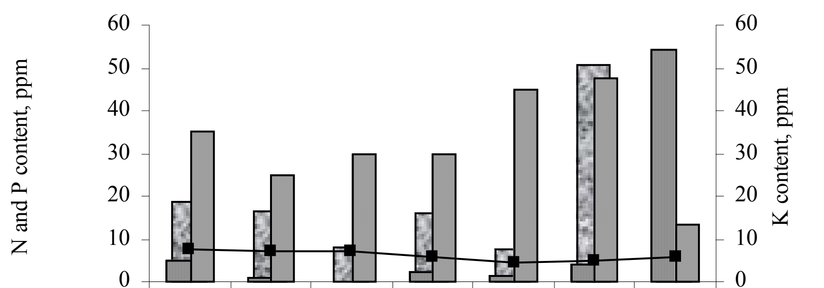
In variant 2 with peat and sand after the application of sulphur, pH decreased from 7.5 to 4.96 and at the end of vegetation period the pH increased to 5.6 (Fig. 2).

The nitrogen content in variant 2 was low and the values varied between 8 and 18.5 ppm. After 14 days from the beginning of experiment the nitrogen content increased to the value of 50.7 ppm. The phosphorus mobility was influenced by the substrate pH.

At the beginning of the vegetation period the phosphorus content was very low and at the end of experiment the phosphorus content increased to the 54.43 ppm. The soluble potassium content was medium and varied between 25 and 47.5 ppm. The variation of potassium content was insignificant and was not influenced by pH variation.

Variant 3 with forestry compost and sand had initially the pH value of 6.04. During the vegetation period after the application of sulphur, pH decreased to the 2.8 value after 14 days and than the pH values increased to 5.21 because of buffering capacity of soil (Fig. 3).

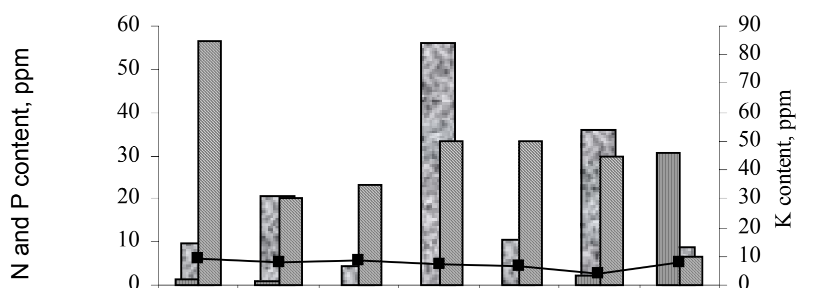
The nitrogen content had a different variation in comparison with the pH variation. Initially the nitrogen content was low (9.75 ppm) and during the experiment period the nitrogen content increased at 20.75 ppm. This process of decreasing and increasing of nitrogen content was the same in the other analysis period.



	T0	T1	T3	T7	T10	T14	Tf
N	18.5	16.25	8	16	7.75	50.7	10.74
P	4.85	1	0	2.1	1.4	4.2	54.43
K	35	25	30	30	45	47.5	13.4
pH	7.5	6.92	6.91	5.66	4.54	4.96	5.6

Time of experiment

Fig. 2. The pH and nutritive elements variation in variant 2.



	T0	T1	T3	T7	T10	T14	Tf
N	9.75	20.75	4.5	56	10.5	35.7	8.86
P	2.2	1.1	0	0.3	0	3.2	46.16
K	85	30	35	50	50	45	10
pH	6.04	5.42	5.85	4.88	4.51	2.8	5.21

Time of experiment

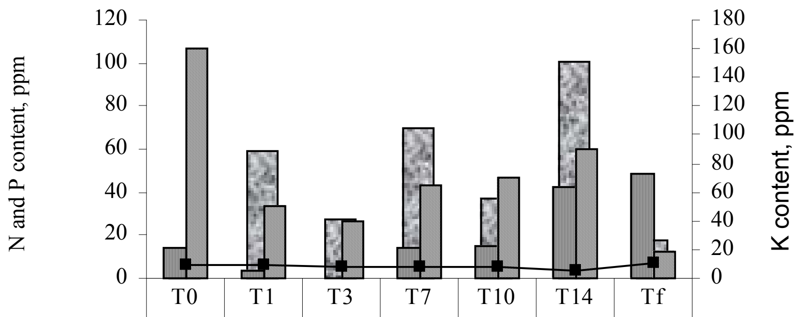
Fig. 3. The pH and nutritive elements variation in variant 3.

The phosphorus content in variant with forestry compost and sand (variant 3) was very low. The potassium content was constant and was not influenced by the pH substrates in variant 3 for all analysis period.

In variant 4 with leaves compost and sand after the sulphur application the substrate pH decreased from 6.0 to 3.83 after 14 days from the beginning of experiment. The content of soluble nitrogen varied between 27.2 ppm and 101 ppm after 14 days of experiment. The phosphorus content varied between 0.32 ppm and 73.25 ppm in the last period of analysis. When the pH values decrease in the mean time the soluble phosphorus content in substrates increased. The higher values of phosphorus were registered after 7 days from the start moment of experiment (Fig. 4).

The analysis of potassium content in substrates shown content almost constant and the values varied between 40 ppm and 70 ppm. The highest value was registered after 14 days from the beginning of experiment and was of 90 ppm. The results obtained did not show a connection between the pH variation and the potassium substrate content In variant 5 with leaves compost, forestry compost and sand initially the pH was 4.86 (Fig. 5).

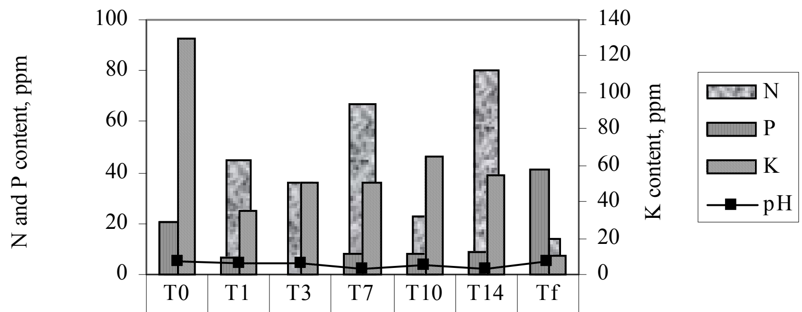
After sulphur application, pH decreased to the 2.44 value in 14[th] day of experiment. The soluble nitrogen content in substrate increased from 10.75 ppm to 80.5 ppm in 14[th] day of experiment.



	T0	T1	T3	T7	T10	T14	Tf
N	2.25	59.2	27.2	69.5	37.5	101	17.6
P	21.2	4.7	0.32	21.1	22.6	63.6	73.25
K	160	50	40	65	70	90	18.75
pH	6	5.98	5.35	5	5.47	3.83	6.69

Time of experiment

Fig. 4. The pH and nutritive elements variation in variant 4.



	T0	T1	T3	T7	T10	T14	Tf
N	10.75	44.75	36	66.7	23	80.5	13.74
P	28.6	9	0.17	11.5	11.4	12.6	57.81
K	130	35	50	50	65	55	10
pH	4.86	4.74	4.15	2.5	3.32	2.44	5.09

Time of experiment

Fig. 5. The pH and nutritive elements in variant 5.

Table 2

Correlation between the nutritive elements and pH for the experimental variants

Substrate	Element					
	Nitrogen		Phosphorus		Potassium	
	r signification	Ecuation	r signification	Ecuation	r signification	Ecuation
Fallow soil+ Manure+ Sand	0.6298 ns	$yN = -10.352x^2 + 84.265x - 110.49$	0.8570 **	$yP = 25.795x^2 - 242.94x + 580.67$	0.4331 ns	$yK = -44.744x^2 + 427.68x - 909.48$
Peat+Sand	0.2590 ns	$yN = 0.7043x^2 - 11.929x + 63.796$	0.4504 ns	$yP = -9.7744x^2 + 115x - 318.05$	0.7834 ns	$yK = 9.313x^2 - 116.5x + 386.2$
Forestry compost +Sand	0.5529 ns	$yN = -3.9438x^2 + 25.896x - 6.4258$	0.2262 ns	$yP = -3.3572x^2 + 30.385x - 57.145$	0.4283 ns	$yK = 8.6146x^2 - 73.117x + 185.49$
Leaves compost+ Sand	0.8321 *	$yN = 6.7295x^2 - 100.61x + 389.21$	0.9170 **	$yP = 28.28x^2 - 297.91x + 792.86$	0.2459 ns	$yK = -6.5151x^2 + 57.592x - 44.885$
Forestry compost+ Leaves compost+ Sand	0.6198 ns	$yN = 15.967x^2 - 134.22x + 307.66$	0.6688 ns	$yP = 14.812x^2 - 104.98x + 185.02$	0.1717 ns	$yK = -8.7321x^2 + 64.269x - 51.682$

The phosphorus content initially was 28.6 ppm. The phosphorus content decreased to 0.17 ppm after 3 days from the beginning of experiment and increased during the decreased of pH values in substrates. The variation of potassium content in variant 5 was the same as in the other variants and was not influenced by the decrease of pH.

The statistics analysis concerning the correlation between the pH evolution and the nutritive elements content presented in Table 2 shows that the nitrogen content had correlation only in variant 4.

The correlation coefficient for variant 4 was significant; for the other variants the coefficient was insignificant.

The phosphorus content had a correlation with the pH evolution in variant 1 and 4; the correlations were distinctly significant.

The phosphorus mobility was influenced by the decreasing of pH. For the potassium the correlation coefficients were insignificant. The soluble potassium content in substrates was not influenced by the pH variation.

CONCLUSIONS

1. The pH values decreased 14 days after sulphur application in all substrates variant studied and the substrate variant with leaves compost, forestry compost and sand registered the lowest pH value of 2.44.

2. The nitrogen content increased 10 days (control) or 14 days (the other variants) after sulphur application and was registered the higher content of 101 ppm in variant 4 with leaves compost and sand.

3. The phosphorus mobility was influenced by the pH and decreased 3 days after sulphur application in all variants and the substrate variant with peat and sand and the substrate variant with forestry compost and sand registered the lowest phosphorus content.

4. The variation of potassium content was insignificant and was not influenced by the pH variation in all substrate variants.

5. The statistics analysis concerning the correlation between the pH evolution and the phosphorus content shown that the phosphorus mobility was influenced by the decreasing of pH and the soluble potassium content was not influenced by the pH variation.

REFERENCES

1. Ansorena M.J.,"Substratos-Propiedades y caracterizacion", Ed. MundiPresna, Madrid, Spania, **1994.**
2. Conover C.A., *How Important are Specific Growing Medium pH`s for Foliage Plants.* **1996,** *3*.
3. Costea G., "Cercetări privind influența substraturilor şi soluțiilor nutritive în cultura containerizată a unor specii

de arbuşti ornamentali", Teza de Doctorat, **2001.** Universitatea de Stiinte Agronomice si Medicina Veterinara Bucuresti (unpublished).

4. Lamaire F., Dartigues A., Riviere L.M., Charpentier S., « Culture en pot et conteneurs » Principes agronomiques et applications. INRA, *Revue Horticole Ed. St.CYR,* **1989**, pp.184–186.
5. Davidescu V., Madjar R., Costea G., Stanica Fl., Caretu G., "Substraturi de cultură", ED. Ceres, Bucuresti, **2001**, pp. 31–56.
6. Madjar R., Davidescu V., Dima I., Neata G., *Acid reaction substances applied effect concerning the total salts content in some substrates, XXXIV* Annual Meeting Novi Sad, Serbia and Montenegro, **2004**, 385–387.