THE TOTAL SOLUBLE SALTS CONTENT AND THE PHOSPHORUS MOBILITY DEPENDENT ON APPLIED FERTILIZER AND OF pH VARIATION IN SUBSTRATE

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Substrate reaction is one of the most important agrochemical indices which affect the plants by their different requirements from this point of view. Substrate reaction or pH is determinate by the presence in the liquid phase of H^+ ions, as result of the ionic equilibrium between liquid phase and solid phase. Some species prefer an acid pH and other accept a large scale of pH, so it is important to know this fact because the commercial fertilizers have great limits of variation for pH (3.5–8). These fertilizers can modify the substrate pH in time.

Salinity expressed as the content of salts dissolved (mg/l or ppm) or electrical conductivity (mS/cm or dS/m) is an agrochemical indicator which can influence the plant growth and development.[1]

Salts accumulation into the substrate can occur by: the presence of high salts concentrations into the constituents of the substrate; the excessive fertilization; the irrigation with improper water; the uncontrolled mineralization of some organic materials.

In order to avoid the negative effects of salinity, the periodically measurement of electrical conductivity in the substrate, the pH control and the correlation of fertilizations with these agrochemical indices are recommended.[2]

The paper presents the results of the total salts content depended of applied fertilizer and of ornamental cultivated specie. The culture substrate was composing by following compounds: leaves compost +forestry compost +peat + marc compost in ratio of 1:1:1:0.5. In year II of culture was followed the growing and development of four ornamental species *Tamarix tetrandra*, *Ligustrum ovalifolium* Aureum, *Chamaecyparis pisifera* Boulevard and *Chamaecyparis lawsoniana* Stardust. Under the effect of fertilizers the substrate pH was modified and the nutritive element release was different in substrate. The content of mobile phosphorus varies with the modification of the substrate pH.

Key words: Substrate pH; Phosphorus availability; Marc grape compost, Ornamental plants.

INTRODUCTION

The nutrition capacity of a substrate vary with the cultivated plant system, which differ with the cultivated species and the fertilizers used.

The solid materials used for the substrate preparation contain ions fixed or absorbed at the mineral or organic colloidal particle surface. This ions fixation take place due to the electrical charge at the surface of colloidal compounds and the presence of some terminal chemical functions, acidic functions of the organic compounds from the substrate (peat). It was observed a difference in the salts content due to the different organic matter content of residual vegetable.[3] The excessive salinity correction can be realized by abundant irrigation – washing, or by fertilization interruption.[4]

In some cases, the use of fertilizers with acid physiological reaction may be a solution for the excessive salinity correction in the substrate.

The mobility of nutrients in soils is well characterized, whereas little information is available for common horticultural substrates based on peat.[5]

The phosphorous represent one of the most important elements in plant nutrition but with some problems of solubility and mobility in substrates.[6]

MATERIALS AND METHODS

The ornamental species *Tamarix tetrandra*, *Ligustrum ovalifolium* Aureum, *Chamaecyparis pisifera* Boulevard and *Chamaecyparis lawsoniana* Stardust was planted in green house in 2007 year in container culture. The plants was fertilized during the vegetation period with Coïc solution to monitoring the elements dynamics in cultivated substrate and the plants response to fertilization which are applying in most of classic substrate in year II of culture.

The organic compounds chosen in cultivated substrate composition was: leaves compost forestry compost, peat and marc grape compost (waste resulted from wine made process) in ratio 1:1:1:0.5. During the vegetation period was applied the specific care works (cutting of vegetative branches for plant uniformity, wetting, weeding, plant protection treatments). In date of 02.06.2008 was made the agrochemical analysis of the substrate and was applied the first fertilization with acidophilic Coïc solution. At 30 days interval time (30.06.2008) the substrate was analysing and a new fertilization was applied, the operation was repeated two times more (31.07.2008, 08.09.2008).

Substrate was agrochemical analyzed by determining the pH, the total soluble salts content, the nitric and ammonium nitrogen, phosphorous, potassium, calcium magnesium soluble content forms, potassium, calcium, magnesium exchangeable content forms and nitrogen, phosphorous, potassium total content forms.

Soluble forms determination extractable in distilled water in ratio 1:10 m/v (1:1.5 v/v) and exchangeable forms extractable in $AcNH_4$ 0.5m pH=4.65, in ratio of 1:3 v/v (Gäbriels and Verdonck methods) was in conformity with CEN (European Committee for Standardization)[7].

RESULTS AND DISCUSSIONS

The total soluble salts content variation (mS/cm) from substrate depends on fertilization applied and ornamental species studied are presented in Table 1.

The differences between substrate total soluble salts content are very significantly negative. The plant nutrition being different depends on species, the highest substrate content being in species culture of *Tamarix tetranda* and the lowest contents at *Chamaecyparis lawsoniana* Stardust because of the higher plant nutrition in that species.

Differences between unfertilized and respect-tively fertilized variants are very significantly negative in the case of *Ligustrum ovalifolium* Aureum specie and positive in *Chamaecyparis pisifera* Boulevard and distinct significant negative for *Chamaecyparis lawsoniana* Stardust, the most intense nutrition being at that species.

The differences between unfertilized and fertilized are very significant negative in the case of *Tamarix* and *Ligustrum* and very significant positive for *Chamaecyparis pisifera* Boulevard and distinct significant in the case of *Chamaecyparis lawsoniana* Stardust (Table 1).

Phosphorous mobility depends on substrate pH. Substrate reaction by soil reaction analogy is a determinant factor in phosphorous mobility, in slow acid pH interval (pH = 5.8–6.4) the phosphorous mobilization is at the maximum intensity. Maintaining the substrate pH between 6 and 7 leaded to the highest phosphorous release in substrate. In moderate and strong acid pH domain

Table 1

Substrate total soluble salts content depended of applied fertilizer and of ornamental cultivated specie

Species	Differences conferred by species						Differences conferred by fertilization	
	UNFERTILIZED (a_1)			FERTILIZED (a_2)				
	mS/cm	Differences	Signification	mS/cm	Differences	Signification	$a_2 - a_1$	Signification
Tamarix tetrandra (b_1)	0.231	Mt	Mt	0.127	Mt	Mt	–0.104	ooo
Ligustrum ovalifolium(b_2)	0.131	–0.100	ooo	0.123	–0.004	ooo	–0.008	ooo
Chamaecyparis Boulevard (b_3)	0.118	–0.113	ooo	0.129	+0.002	xxx	+0.011	xxx
Chamaecyparis Stardust (b_4)	0.105	–0.126	ooo	0.108	–0.019	oo	+0.003	xx

DL 5% = 0.00105 mS/cm
DL 1% = 0.00144 mS/cm
DL 0.1% = 0.00196 mS/cm

DL 5% = 0.001272 mS/cm
DL1% = 0.002336 mS/cm
DL0.1% = 0.005176 mS/cm

and also for neutral and alkaline the mobile phosphorous concentration decrease because of insoluble phosphorous compounds obtained. Substrate phosphorous accessibility depends on pH, the reaction that conducted phosphorous relegation in calcium compounds at pH > 7.3 and in iron and aluminium compounds at pH < 5.5. If the substrate solution reaction is alkaline in presence of exchangeable calcium and magnesium formed salts with low solubility as calcium monohydrogen phosphate $CaHPO_4$ or tertiary calcium phosphate $Ca_3(PO_4)_2$.

At the starting in vegetation (02.06.2008) in substrate the P mobile values varying between 220.25 ppm and 241.75 ppm and the pH between 7.62 – 7.93, the correlation coefficient being of r = 0.3665 (Fig.1).

After one month of vegetation (30.06.2008) the substrate pH increase because of marc compost compound correlation coefficient being of r = 0.5862 (Fig. 2).

The applied of nutritive acidophilic Coïc solution reacted in the next 30 days of applied (31.07.2008) by decreasing of the substrate pH vary between 7.22–7.69, correlating unsignificant with the mobilized quantity of phosphorous (r = 0.3440) (Fig. 3).

At the last analysis at 08.09.2008 the correlation between mobile phosphorous and substrate pH values respect the same direction as determination from 31.07.2008, the correlation coefficient value being of r = 0.3351 (Fig. 4).

CONCLUSIONS

1. Differences of substrate total soluble salts content are very negative significant, the plant nutrition depends on specie, the highest salts content in substrate being in culture of *Tamarix tetranda* and the lowest was in the case of *Chamaecyparis lawsoniana* Stardust, a specie with the most intense nutrition.

2. The differences between unfertilized and fertilized are very significant negative in the case of *Tamarix* and *Ligustrum* and very significant positive for *Chamaecyparis pisifera* Boulevard and distinct significant in the case of *Chamaecyparis lawsoniana* Stardust.

3. Soil reaction and soluble total salts content have not significant variation after Coïc solution applied. The results have been explained by the substrate buffer capacity reaction used in container culture of some ornamental species.

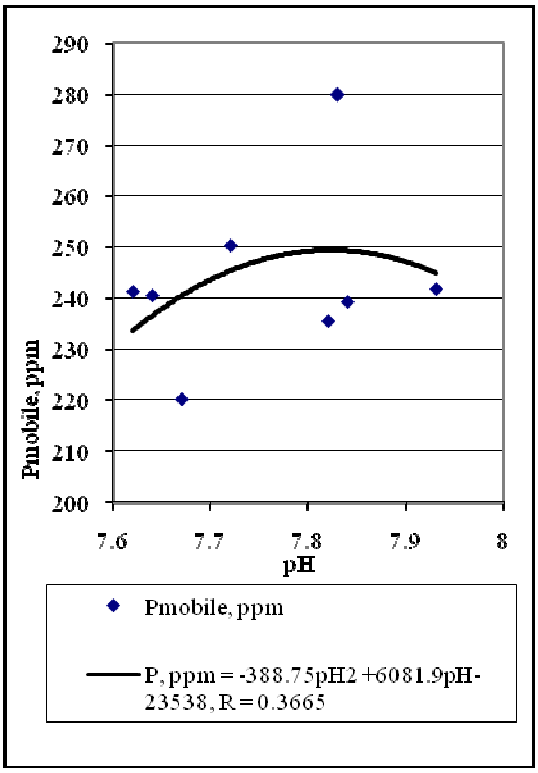

Fig. 1. Correlation between P and substrate pH (02.06.2008).

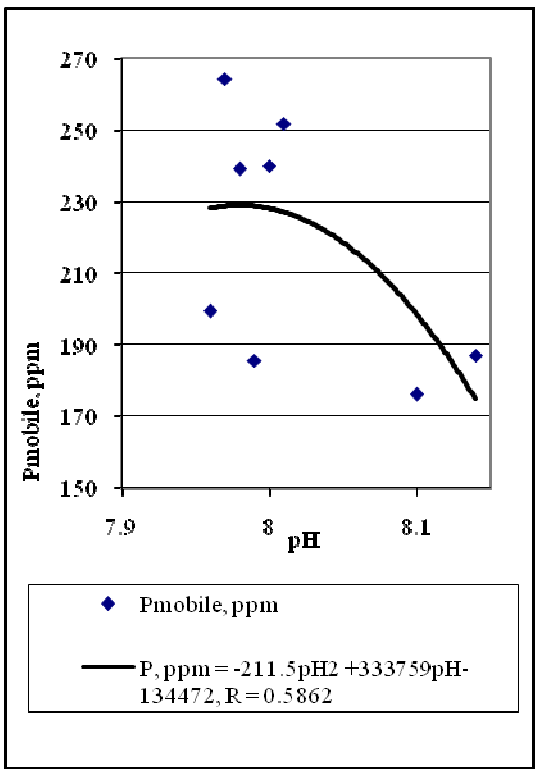

Fig. 2. Correlation between P and substrate pH (30.06.2008).

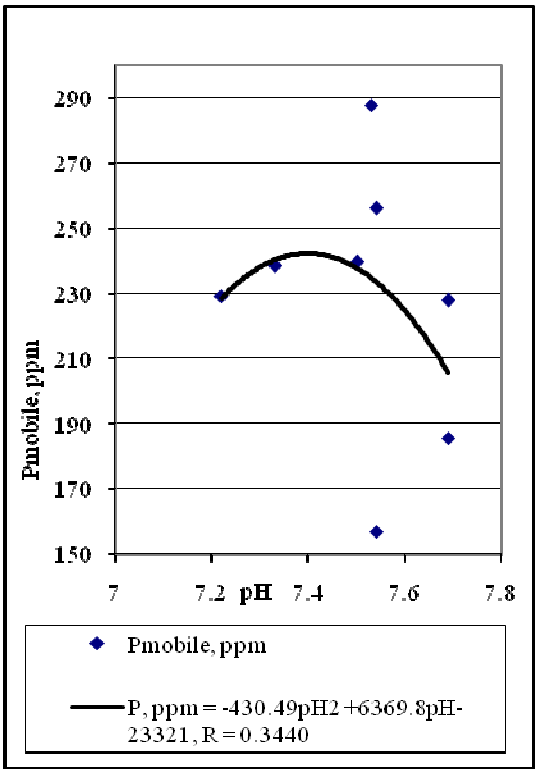

Fig. 3. Correlation between P and substrate pH (31.07.2008).

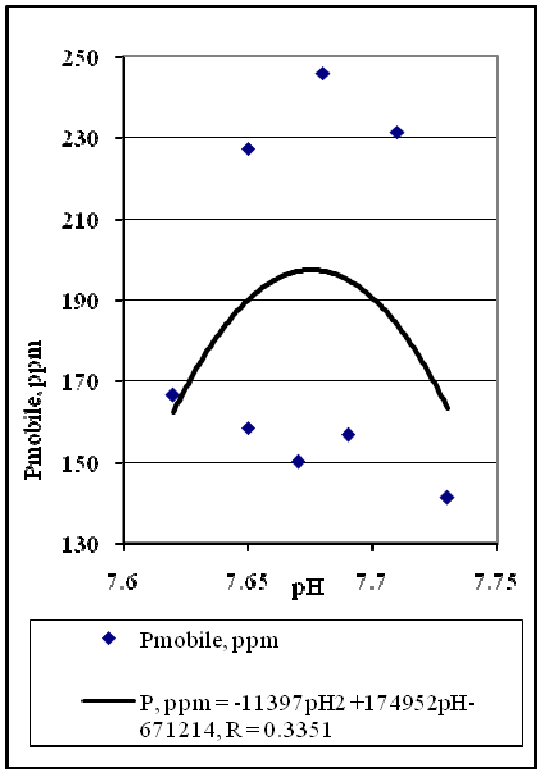

Fig. 4. Correlation between P and substrate pH (08.09.2008).

4. The mobile phosphorous quantity is higher in substrates with pH between 6 and 7, in analyzed substrate the P mobile values varying between 220.25 ppm and 241.75 ppm and the pH between 7.62–7.93, the correlation coefficient being of r = 0.3665.

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