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Research Article

IMPROVEMENT QUALITY OF IMPATIENS AND OLEANDER PLANTS WITH CHABAZITIC-ZEOLITES

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ABSTRACT

In order to improve the growth of Impatiens and Oleander plants, several experiments were conducted in which chabazitic- zeolites were added to cultivation substrates to assess their influence on plant growth and reduction of fertilizer use. The experiment on Impatiens and Oleander involved 4 treatments: control with total fertilization; control with reduced fertilization; substrate with chabazite and total fertilization; substrate with chabazite and reduced fertilization.

The results showed an improvement in the growth of Impatiens and oleander plants and a reduction in the use of fertilizers in substrates with added chabazite. Further experiments will be carried out in order to have more data on the growth of the different ornamental and horticultural species, also based on the variation in the percentage of chabazite in the mixture.

INTRODUCTION

The Impatiens, commonly called glass flower, is a cheap plant and very simple to grow. The name of this plant comes from the fact that its fruits, once ripe, open violently, spreading away the seeds. Includes more than 500 annual or perennial species belonging to the Balsaminaceae family (Ecke, 1994). These plants come from tropical East Africa and are mainly appreciated for their abundant flowering, ease of cultivation and rapid growth. They have fleshy stems and solitary or double flowers gathered in cobs or racemes. There are so many Impatiens on the market, of different shapes and colours, especially thanks to the numerous cultivars that have been gradually selected.

Among the most famous Impatiens we remember the Wallerian (in honour of Horace Waller, a British missionary) or the Impatiens holstii or sultanii (in honour of the Sultan of Zanzibar) (Erwin, 1992). Impatiens requires temperatures around 18 °C, but also withstands higher thermal conditions. Even in winter it would be preferable for the temperature to remain around these values so that the plant continues to bloom. Temperatures below 13 °C are not tolerated. A fertile soil mixed with peat and sand is used for cultivation to ensure good drainage. The Impatiens in their places of origin bloom almost all year round. In our climates, however, they begin to bloom in May and continue throughout the summer (Mikkelsen, 1994; Miller and Williams, 1994).Oleanders are evergreen shrubs that are particularly appreciated in the Mediterranean area and in East Asia for their beautiful blooms (Atilano, 1981). The genus Nerium, belonging to the family of Apocynaceae, includes evergreen shrubs widespread in the Mediterranean regions, thanks to their ability to withstand very high temperatures (over 40 ° C) and saline environments (Broschat *et al*., 1991). Normally they are found along the coastal avenues where they form conspicuous and colorful hedges that resist without problems to the exhaust gases of cars. Among the main species we remember Nerium oleander, the most widespread that in nature can reach 6 meters in height and the *Neriumindicum* also known as *Neriumodorum*, species widely spread in China and Japan (Gilman *et al*., 1994).

Zeolites have been used in this experiment because they have several interesting characteristics for use in agriculture, particularly in horticulture. The use of zeolites in tomatoes (Passaglia *et al*., 1997), celery (Bazzocchi *et al*., 1996), courgettes and melons (Passaglia *et al*., 2005b), vegetables and fruit (Passaglia e Poppi, 2005 a,b) has led to an increase in total finished production per hectare of land. In floriculture, the use of zeolites has led to an increase in height, in the total number of inflorescences, buds and flowers, in the size of the bulbs and a higher precocity of flowering in geranium (Passaglia *et al*.,

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1998; Passaglia *et al*., 2005a), lilium, gerbera, chrysanthemum, *Liatrisspicata*, tulip, *Cupressussempervirens*, olive trees, camellia and leucospermum (Prisa and Burchi, 2015). In this experiment, carried out at CREA-OF in Pescia (PT), we wanted to investigate the possibility of reducing fertilization in substrates containing chabazitic-zeolites on species such as Impatiens and Oleander.

MATERIALS AND METHODS

Greenhouse Experiment and Growing Conditions

The experiments began in early May 2017, were carried out price experimental greenhouses of the CREA-OF of Pescia (Pt), Tuscany, Italy (43°54′N 10°41′E)on plants of impatiens and Oleander. The plants were placed in pots ø 14 cm; 30 plants for thesis divided into replicas of 10 plants each. The chabazitic- zeolites supplied by BalCo of Sassuolo (MO) (company specialized in the sale of minerals and rocks for ceramics and agriculture)had the following characteristics: 1) qualitative-quantitative mineralogical analysis (% by weight with standard deviations in brackets) carried out by X-ray powder diffractogram according to the RIETVELDRIR methodology (Gualtieri, 2000): chabazite 66.2 (1.0); phillipsite 2.4 (0.5); mica 5.6 (0.6); K-feldspar 10.3 (0.8); pyroxen 2.2 (0.5); volcanic glass 13.3 (1.5);2) Total zeolithic content (%): 68.6 (1.3), of which 66.2 due to chabazite and 2.4 from phillipsite. Cation exchange capacity (in meq/g with standard deviation in brackets) determined using the methodology described in Gualtieri *et al*. (1999):2.15 (0.15) of which 1.42 due to Ca, 0.04 to Mg, 0.05 to Na and 0.64 to K.The experimental theses of the test for both impatiens and oleander were: control 1 (CTRL1): peat 100% + full fertilization (5 g of nutricote 6-8 months per liter of substrate); control 2 (CTRL2): peat 100% + half fertilization (2,5 g of nutricote 6-8 months per liter of substrate); chabazitic-zeolites 1 (CABA1): peat 80% + chabazite 20% + full fertilisation (5 g nutricote 6-8 months per litre of substrate); chabazitic-zeolites 2 (CABA2): peat 80% + chabazite 20% + half fertilisation (2,5 g nutricote 6-8 months per litre of substrate). The measurements carried out at the end of the experiment on the plants were: plant height, leaves number, fresh weight of the vegetative part, fresh root weight, precociousness of flowering.

Statistics

The experiment was carried out in a randomized complete block design. Collected data wereanalysed by one-way ANOVA, using GLM univariate procedure, to assess significant ($P \leq 0.05$, 0.01 and 0.001) differences among treatments. Mean values were then separated by LSD multiple-range test ($P = 0.05$). Statistics and graphics were supported by the programs Costat (version 6.451) and Excel (Office 2010).

Results

The test showed how zeolites can significantly improve different agronomic characteristics of plants such as Impatiens (Fig.1) and Oleander (Fig. 2). In fact, in Tables 1 and 2 it is noted that the treatment with chabazite can significantly increase all the agronomic parameters that have been taken into account in the experiment. In particular on oleander (Tab. 1), the theses with chabazite at full and half fertilization were better than the control, for plantsheight, leavesnumber, fresh weight of the aerial and radical part (Fig. 3). Even the data show that the treatment with chabazite with reduced fertilization is significantly better than the control treatment with full fertilization, this can ensure the grower the ability to use a smaller amount of fertilizer in the substrate obtaining the same excellent plant. The same results are confirmed in the Impatiens test (Tab. 2), where treatments with chabazite with full and reduced fertilization guaranteed a higher growth of the plants compared to the control treatment (Fig. 4).In this experiment we also see an increase in the root development of plants treated with chabazite; this last aspect is especially important in the post-transplant phase when the plants of the nursery, cultivated under conditions of irrigation and controlled fertilization, pass in an open field environment where they can often die.

A more developed root system can give the plant a better chance of resisting water and salt stress. There is also an early flowering rate of about 7 days in the Oleander plants grown in the substrate with chabazite.

Table 1 Effect of zeolites on the agronomicgrowth of Oleanderplants

Treatment	Plantheight (cm)	Leaves number per plant (n°)	Freshleaves weight (g)	Freshroots weight (g)
CTRL1	10.92 c	6.90 b	104.3 c	81.44 b
CTRL2	8.34 d	5.10 c	87.96 d	65.89 c
CHABA1	17.90 a	10.30 a	121.43 a	93.35 a
CHABA2	15.62 b	7.50 b	112.69 b	85.22 b

Each value reported in the graphis the mean of three replicates ± standard deviation. Statistical analysis performed through one-way ANOVA. Different letters for the same parameter indicate significant difference saccording to LSD test (P = 0.05).

Table 2 Effect of zeolites on the agronomicgrowth of Impatiensplants

Treatment	Plant diameter (cm)	Fresh leaves weight (g)	Freshroots weight (g)
CTRL1	8.25 b	62.29 c	44.10 c
CTRL2	6.14 c	54.89 d	37.85 d
CHABA1	10.80 a	77.41 a	54.71 a
CHABA2	8.41 b	70.97 b	46.87 b

Each value reported in the graph is the mean of three replicates ± standard deviation. Statistical analysis performed through one-way ANOVA. Different letters for the same parameter indicate significant differences according to LSD test (P = 0.05).

Fig 1 Plant ofImpatiens on cultivationbench

Fig 2 View of the Oleanderplants under test

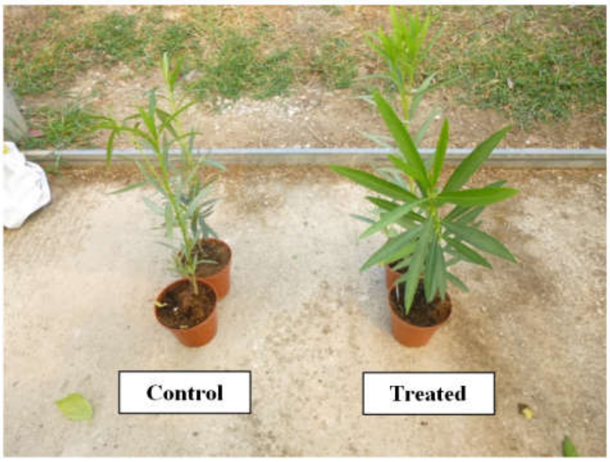

Fig 3 Effect of chabazitic-zeolites on Oleanderplants

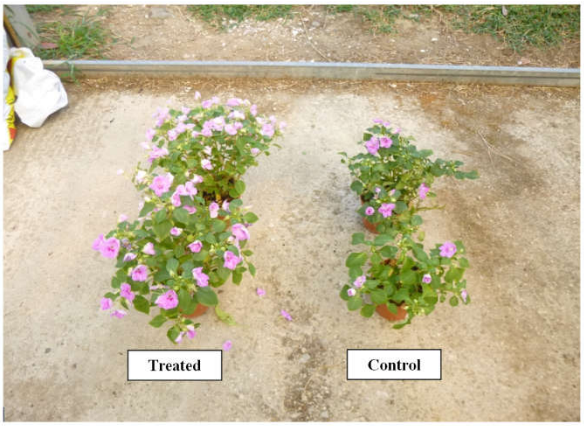

Fig 4 Comparisonbetween the plants of impatiensgrown in substrate with chabazite and the control plants.

DISCUSSION

The use of chabazite, as demonstrated by this test, can guarantee the grower a qualitative improvement of the plants in cultivation, reducing the costs for fertilizers. The zeolites and, more particularly, the chabazite, in fact, once introduced in the substrates of cultivation or in open field, can increase the quality of the plants, retaining water and fertilizers and making them available at the moment of need (Prisa and Burchi, 2015). In this experiment, it is noted above all that the growth substrates of the oleander and Impatiens plants treated with zeolites determined a significant increase in all the agronomic parameters analysed (plant height, plant diameter, number of leaves and fresh weight of the vegetative parts). In particular, plants grown in chabazite show a significantly higher root weight than control plants, which is especially important in the post-transplantation phases in the open field, when from a nursery phase, in which the water and fertilizer content are controlled in pots, there is a situation of uncontrol and increases the mortality rate. These data once again underline some of the positive effects that chabazite could have when used in the cultivation of ornamental plants. A decisive factor is, in particular, the purity of the mineral used. Determining the chemical-physical characteristics is in fact of particular importance in order not to run into problems during the cycle of cultivation in pots or in the open field. A new decree of March 3, 2015, proposed by prof. Passaglia (Passaglia, 2008), indicates the non-commerciality of zeolites that do not contain within their structure a content greater than 50% of that particular mineral. This is to limit the marketing of products that are not of quality and to ensure that people who use this type of mineral can not then encounter problems of phytotoxicity on plants in cultivation.

CONCLUSION

These trials showed several benefits that can be obtained through the use of chabazitic-zeolites: improvement of quality in impatiens and oleander plants, better use of fertilizers and water, alternative inorganic substrates which may replace those normally used.Further experiments will be carried out in order to have more data on the growth of the different ornamental and horticultural species, also based on the variation in the percentage of chabazite in the mixture.

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