

# Changes in growth, essential oil yield and composition of geranium (*Pelargonium graveolens* L.) as affected by growing media

Abdolhossein Rezaei Nejad<sup>a,b\*</sup> and Ahmad Ismaili<sup>c</sup>

## Abstract

**BACKGROUND:** Using proper growing medium is known to be an effective way to improve crop growth and yield. However, the effects of growing media on geranium essential oil have scarcely ever been examined in detail. In this research, the effects of different growing media (soil, sand, pumice, perlite and perlite + cocopeat) on growth, oil yield and composition of geranium were studied.

**RESULTS:** Growth was significantly improved in soilless-grown plants compared with soil-grown plants. Oil yield of soilless-grown plants (except for pumice) was about threefold higher than that of soil-grown plants. The increase in oil yield was correlated with higher leaf dry weight ( $r^2 = 0.96$ ), as oil content was not affected. The citronellol/geranium ratio of oil was clearly affected by growing media, ranging from 5:1 in soil culture to 3:1 in soilless culture. The latter is acceptable for perfumery.

**CONCLUSION:** Compared with soil, soilless media could produce higher yields of high-quality geranium oil that fits market requirements. Growth, oil yield and composition of plants grown in sand (a cheap and abundant growing medium) were not significantly different from those of plants grown in perlite and perlite + cocopeat.

© 2013 Society of Chemical Industry

**Keywords:** *Pelargonium graveolens* L.; soil culture; soilless culture; citronellol; geraniol

## INTRODUCTION

Geranium (*Pelargonium graveolens* L.) is an important aromatic plant. Geranium oil with its strong rose-like odor is extensively used in the perfumery, aromatherapy, cosmetic, food and pharmaceutical industries.<sup>1–3</sup> The major natural components of its essential oil are citronellol, geraniol, linalool, citronellyl formate and menthone.<sup>4</sup> Commercial geranium essential oils are characterized by a high concentration of citronellol (up to 45%) and lower amounts of geraniol (<24%) and linalool (<14%).<sup>5</sup> In Iran, geranium is cultivated as a greenhouse crop in soil-based media. It has been shown that the essential oil content and composition are affected by many factors such as plant genetics,<sup>6,7</sup> leaf age,<sup>8</sup> light intensity,<sup>9</sup> temperature,<sup>10</sup> transplanting date,<sup>11,12</sup> season and time of harvesting,<sup>13,14</sup> climatic conditions<sup>8,15,16</sup> and fertility conditions.<sup>17</sup> A literature survey revealed that, as far as is known, there has been no report where changes in essential oil yield and composition of geranium have been studied in relation to growing media. Therefore the aim of this work was to elucidate the effects of different growing media on growth, essential oil yield and quality of geranium.

## MATERIALS AND METHODS

### Plant material and growth conditions

The experiment was carried out in a greenhouse at the research field of the Faculty of Agriculture, Lorestan University, Khorramabad, Iran (latitude 33° 29' N, longitude 48° 22' E,

altitude 1125 m) during April–November 2011. The greenhouse conditions were temperature 22–28 °C, relative humidity 60–90% and light intensity *ca* 600  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Terminal stem cuttings with five nodes were obtained from mother plants in the same greenhouse and placed in a sand substrate for rooting in April. Uniform rooted cuttings were then transplanted into plastic pots (25 cm diameter and height) filled with one of the following substrates: soil, sand, pumice, perlite or perlite + cocopeat (equal proportions). Transplanting was done in June and one plant per pot was cultivated. Plants cultivated in soil were irrigated with tap water twice a week. Soluble fertilizer (1.25 g L<sup>-1</sup> of 20N-20P-20K) was dissolved in the irrigation water once every 2 weeks throughout cultivation. Plants cultivated in sand, pumice, perlite or perlite + cocopeat were irrigated through a trickle system with Hoagland's medium (electrical conductivity (EC) 1.7 dS m<sup>-1</sup>, pH 5.8) twice a day. Soil for soil culture was prepared from

\* Correspondence to: Abdolhossein Rezaei Nejad, Department of Horticultural Sciences, Faculty of Agriculture, Lorestan University, PO Box 465, Khorramabad, Iran. E-mail: Rezaeinejad.h@lu.ac.ir

a Razi Herbal Medicines Research Center, Lorestan University of Medical Sciences, Khorramabad, Iran

b Department of Horticultural Sciences, Faculty of Agriculture, Lorestan University, PO Box 465, Khorramabad, Iran

c Department of Agronomy and Plant breeding, Faculty of Agriculture, Lorestan University, PO Box 465, Khorramabad, Iran