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Greenhouse Production of Lemon Verbena and Valerian Using Different Soilless and Soil Production Systems

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ABSTRACT

In order to assess the growth potential and essential oil production of valerian(*valeriana officinalis var . common*) and lemon verbena (lipia citriodora. var verbena) in various soilless and soil production system which consisted of floating, aeroponic, growing media, and soil media an experiment was conducted in a research greenhouse in. The plants were harvested after six months and their vegetative trials, root characteristic and essential oil content were measured. In valerian plants the highest fresh weight of both leaves (802 g plant^{-1}) and roots (364.5 g plant^{-1}) was observed in floating system. The concentration of essential oil in both floating and aeroponic systems was higher compare to those of growing media and Soil systems. In valerian plants volume of roots in the floating and aeroponic was significantly higher and led to the increased total essential oil content. No significant difference in leaf area was found between floating and growing media systems. But it was considerably reduced in aeroponic and soil systems. In lemon verbena plants, the fresh weight of leaves was significantly increased in floating system compare to other systems. Different systems had no significant effect on the essential oil concentration in lemon verbena however; the total content of oil in floating system was significantly increased as the result of higher fresh weight of the leaves. It can be concluded that both floating and growing media systems could be use for production of both valerian and lemon verbena under greenhouse. In general different culture systems under greenhouse condition can be used for more efficient production of some medicinal and aromatic plants.
KEYWORDS: *Greenhouse production, verbena , valerian, soil production systems.*

1. INTRODUCTION

Nowadays medicinal and aromatic plants are produced and processed in commercial scale. Since most medicinal plants are consumed as raw material or cultivated for using of this active substance and also the demand for many of them has increased , proper management of production is needed to achieve more productivity and high quality products .Production of medicinal and aromatic plants in controlled environments (CE) improve biomass production, yield quality and bioactivity of raw materials and produce high quality herbs and raw material free from accidental adulteration by weeds pathogens and soil or environmental toxins**.**(1, 6,7,8). Hydroponic which is known as a method of growing plants without soil, has long been the subject of much public interest in most parts of the world? Fast Development of this system in few last decades in many of world's country is a result of its capability of being independent to the soil and eliminating many of its problems (11) .This production system is an efficient alternative for countries with limited agricultural soils and water sources shortage. Hydroponic culture has employed as an economic and environmentally viable means for the mass production of vegetables and flower in most parts of the world and growing of different vegetables has been demonstrated in hydroponic system by many of studies(3,12). Hydroponic production of medicinal and aromatic plants is a new trend in agricultural system, particularly in organic and intensive agriculture.(4). High productivity, cleaner, off- season, and cost- effective production, water use efficiency, adequate aeration, abundant water availability, drastic increase of photosynthetic potential and elimination of hard and labor consuming works such as cultivation, loosening, weeding, irrigation, have been defied as the main advantages of soilless production systems.(8,4) all these advantages can be used by shifting from labor consuming, expensive traditional culture of medicinal plants to industrial production in greenhouse hydroponic system .the possibility and economical benefits of medicinal plants cultivation in hydroponic system has been proved(8) and it has been shown that accumulation of bioactive substance in soilless culture can also affect crop productivity in intensive crop production system(10) . However there is very little information available on the effect of different soilless culture methods on the growth potential and secondary metabolites including essential oil production in medicinal plants. The aim of this study was to asses the growth potential and essential oil production of valerian and lemon verbena in various soilless and soil cultivation in greenhouse.

2. MATERIALS AND METHODS

This experiment was conducted in the research greenhouse of Horticultural sciences Department, Tabriz University. The experiment was arranged in completely randomized design (CRD) with three replicates. Four

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production systems including floating (Fl), Aeroponic(AE), Growing media(GM) with perlite and vermiculite with 1:1 ratio and soil media (SM) were used for growing the plants and as treatments. Four frames were built using 3 cm polystyrene constructed in a box frame configuration. In aeroponic systems, entire unit was covered with 3 cm polystyrene to protect the root zoon from light and to prevent loss of solution. An external one horsepower centrifugal pump; drew nutrient solution from the reservoir, pumping it through six spray nozzles arranged uniformly blow the units .A digital timer was used to control the frequency and duration of the spray. This units sized 0.75*.3*2 m and randomly placed in the greenhouse where was under natural sunlight during spring and summer and the temperature was set 28±3(day) and 20±3 night during the entire experiment period. Four week old valerian seedlings and six week rooted lemon verbena cutting were transplanted into the units, each containing six plants. Initially, all plants were fed with a nutrient solution with half strength of Hoagland solution and then the treatments were imposed. For all soilless treatments standard nutrient solution was adapted from Hoagland and Arnon (1950)(5) solution depending on the analysis of the local water. Two plants from each plot were harvested for the study of their growth characteristics and oil content. Biomass production (fresh and dry weight of the plants were measured for each plants after harvesting. Leaf area was measured by leaf area meter (LI-3100, LI-COR,inc. Lincoln, USA). leaf chlorophyll meter(Minolta, Osaka, Japan) on the 4 th, 8 th and 12 th leaves(counted from uounger leaves) in to plants from each experimental unit. Essential oil was extracted by Hydro distillation of 500 g fresh weight of leaves in lemon verbena and the roots of valerian plants. Analysis of variance was carried out using generalized linear models in the sas program. Differences between treatments were tested BY THE student t- test ($p \leq .05$) and difference between means were tested by LSD.

3. RESULTS

In both valerian and lemon verbena plants, the highest fresh weight of both leaves and roots was observed in the floating system (Table1). In lemon verbena plants, the fresh weight of leaves was significantly increased in floating system compared to other systems. No difference in fresh weight of leaves was found between aeroponic and growing media systems, but it was reduced significantly in soil media system. In both two plants, those which were grown in soil media had lower fresh and dry weight than hydroponic grown ones. Leaf area of valerian and lemon verbena in floating system compared to soil system was increased by 94% and 90% respectively (fig 1). Volume of roots of valerian in both FL and AE systems 89% higher than that in SM system (fig 2). No significant difference in root volume was found between FL and GM systems however, it was reduced considerably in AE and SM systems. In valerian plants. According to the results, lemon verbena plants had significant difference in leaf chlorophyll level. The highest leaf chlorophyll was observed in soil media system and there was no difference between hydroponic systems. There was no leaf chlorophyll difference between valerian plants grown in different systems. In valerian plants the concentration of essential oil in floating systems was higher than other systems. (Figure 3), while no significant difference was observed in Aeroponic, growing media and soil systems. However in lemon verbena different systems had no significant effect on essential oil concentration .when data for essential oil production transferred into fresh weight of leaves or root per-plant basis , oil content in floating system was significantly increased in valerian and lemon verbena as the result of higher fresh weight of the roots or the leaf. On a plant basis, lowest essential oil production in both plants was observed in soil system.

4. DISCUSSION

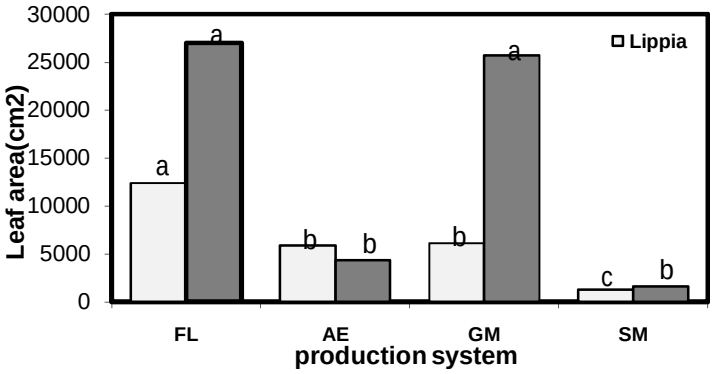
Various forms of soilless culture systems with or without an inert substrate such as perlite have been described by Schwarz (1992) (12). All systems it is vital to maintain the highest possible aeration, nutrient solution availability and adjusting the concentration of nutrient at all times. The increased biomass production in both Floating and growing media systems was due to increased leaf area as the photoassimilation sources for the plant that is a result of being exposed to the optimum growth condition (2, 13). Our result showed that both Floating and Growing media system might be an appropriate system for the growing of medicinal and aromatic plants, which is in agreement with the finding of Dorais et al, (1) who studied many of medicinal plants in different hydroponic systems .Thy found that floating rafts system were well adapted to the most medicinal plants.After90 days , root fresh weight of stellaria media , Artemisia vulgarisand Inula helenium was 3.0, 1.7 and 9.0times, respectively, higher in the floating rafts system compared to field growing plants. Pagliarulo and Hyden(6,9)indicated that aeroponics cultivation of Echinacea and Burdock is superior had superior yields compared to conventional field productionother studies showed that hydroponically grown aromatic plants had high productivity, in addition to accumulation 3-6 timesmore essential oil per unit of feeding surface, compared to field grown ones(8). Higher planting densities, adjustment of nutrient concentration and multiple harvests may increase the yield in soilless cultivation in greenhouse over those of field production. Furthermore more biomass production in hydroponic systems is the reason for more essential oil extraction of medicinal plants grown in these systems. The results suggest that both floating an growing media production systems could dramatically out perform soil production system, since it appeared that the growth of the medicinal plants tended to be lower in soil production system.In valerian plants losing of the roots in soil production in the harvest process are most likely to be representing a significant loss of yield potential in root plants. Therefore, the easily accessible roots in both aeroponic and floating systems might be trimmed and to to re-growth in this biennial plant, yielding additional biomass with subsequent harvests.

5. Conclusion

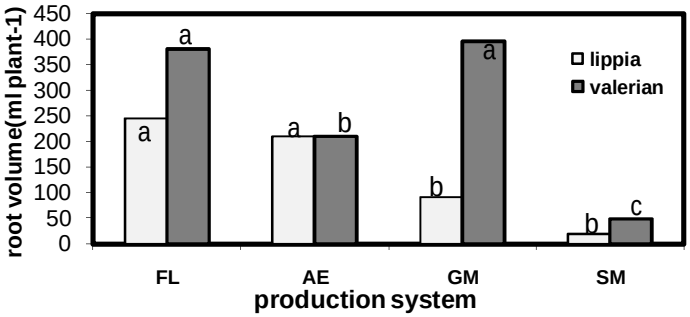
The results of both the valerian and lemon verbena experiments suggest that both floating and growing media cultivation are capable of Equivalent and superior yields compared to soil production. Higher planting densities, improved plant varieties, and multiple harvests may increase yields significantly over those of field production. aeroponic Systems also can be used for production of medicinal root crops, however sufficient care is needed to obtain higher yield. In general, it could be possible to produce some medicinal plants in different production system in greenhouse

Table 1. Effect of production system on the vegetative characteristics of valerian and lemon verbena

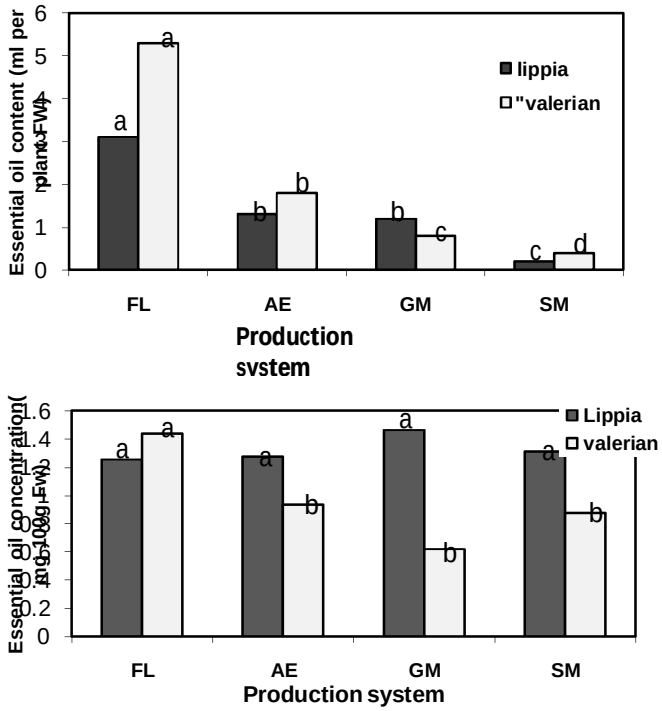
Production system	Leaf Fwt (g)		Leaf Dwt (g)		Root Fwt (g)		Root Dwt (g)		Chlorophyll index	
	Lemon verbena	Valerian	Lemon verbena	Valerian	Lemon verbena	Valerian	Lemon verbena	Valerian	Lemon verbena	valerian
Floating	250.3a	802.6a	58.0a	88.0a	242.4a	364.4a	26.3a	22.71a	33.0b	40.6
Aeroponic	100.9b	306.6bc	24.8b	38.4b	202.8ab	208.0b	29.1a	18.66a	35.53ab	40.1
Grow. med	120.0b	575.2ab	18.7bc	102.9	95.3bc	291.4ab	14.7b	19.0a	33.3b	40.0
Soil	18.1c	53.4c	4.9c	8.1c	13.05c	52.5c	2.31c	5.8b	39.433a	37.0
Significance	0.0001	0.001	0.001	.0001	.001	.001	.001	.01	0.05	ns



Figuer1. The effect of production system on lef area of valerian and lemon verbena plants



Figuer2-. Root volume in valerian and lemon verbena plants grown in different production system



Figuer3. Essential oil content and concentration of lemon verbena and valerian plants grown under different production system in greenhouse.

6. REFRENCES

1- Dorais, M., A.P.P Papadopulos, X Luo, S Leonart, a. Goosselin, k.Pedneault, P. Angers, and L. gaudreau. 2001. -Soilles greenhouse production of medicinal plants in north eastern Canada. Acta hort. 554: 186:189.

2- Field, C. B 2003. Environmental control of leaf areaproduction implication for vegetation and land – surface modeling.Global biochemical cycles.17(1):1007

3- FAO. 1990. Soilless culture for horticultural crop production.FAO, Paper 101, Rom, Italy

4- Hassanpouraghdam. M. b., S.J tabatabaeie, Nazemiyeh. H and A Aflatuni, J. Essent. Oil Bear. Plant. 11 (2008) 649.

5- Hogland, D.R. and arnon, D.S. 1950. The waterculture method for growing plants without soil. Calif. Agric. Exp. Stat. Circ. 374: 1-32

6- Hyden, A.L, 2oo6. Aeroponic system for medicinal herbs, rhizomes and root crops. HortScience, 41(3):536-538

7- Leonart, S., Pednealt, K., Gossellin,A., Angers, P., Papadopoulos, A.P and dorais, M. 2002Diversification of greenhouse crop production under supplemental lighting by the use of new culture withhigh economic potential. ActaHort, 580

8- Mairapetian, S.K. 1999, ActaHort. 502:33

9- Pagliarulo,C.l and hayden, A.L. 2000. Potential for greenhouse aeroponic cultivation of medicinal root crops. Controlled Environment Agriculture Center, Department of plant science University of Arizona, Tacson, Arizona.

10- esh, H.M. 1989. Hydroponic food production. 4th ed. Woodbridge press, Sana Barbara.CA. pp.

11- Savvas, D. 2003. Hydroponic: A modern technology supporting the application of integrated crop management of greenhouse. Food, Agriculture and environment, (1): 80-861-50

12- Schwarz, M. 1995. Soilless Culture Management, Springer. Berlin Heidelberg, Germany.

13- Taiz. L. and Zeiger, E. 2002. Plant physiology.Sinaur associate, Inc . Publisher. Sunderland, USA