AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

The effect of vermicompost and biological phosphate on morphological characteristics and rosemarinic acid of Iranian borage (*Echium amoenum* Fisch and May.)

Rahim Haghi and Hassan Nourafcan

Department of Horticulture, Miyaneh branch, Islamic Azad University, Miyaneh, Iran

ARTICLE INFO

Article history:
Received 26 September 2014
Received in revised form 20 November 2014
Accepted 25 December 2014
Available online 2 January 2015

Keywords:
borage, Rosemarinic acid, HPLC, vermicompost.

ABSTRACT

The main purpose of the present study was to investigate the effect of vermin compost, biological phosphate and their combinations on the quality and agricultural characteristics of borage using a randomized complete blocks design with three replications in Meshkinshahr area during 2012-2013. The measured traits included the number and length of florescence, number of flower in the florescence, length of flower, length of leaf, dry weight of flower and rosemarinic acid content. Rosemarinic acid was measured by HPLC method. The results of the variance analysis showed that the compost traetments had significant impact on all of the evaluated traetments. The highest dry weight of flower was observed in the compost cares and combination of vermin compost and bio-phosphate and the lowest dry weight of flower were observed in traetments. Based on the obtained results, the highest degree of rosemarinic acid was found in vermicompost traetment. The result also showed a significant positive correlation between number of flowers and the dry weight of flower and number of stalks. Moreover, significant positive correlation was found between the length of leaf and flower dry weight. The results showed that the quality and quantity function of the borage flower could increase with the application of bio-composts.

To Cite This Article: Rahim Haghi and Hassan Nourafcan., The effect of vermicompost and biological phosphate on morphological characteristics and rosemarinic acid of Iranian borage (Echium amoenum Fisch and May.) ***Adv. Environ. Biol., 8(25),*** *704-708, 2014*

INTRODUCTION

The soil is one of the most complex and complicated ecosystems of the world so that in despite of some progressions considerably in the field of humanistic technology, presumably scientists and researchers cannot completely recognize the world of the soil and it has been still left as a black box for these scientists. The main part of this complexity is subjected to the live section of the soil.The creatures and particularly microscopic creatures play key role in increasing the ability of the plants using the nutritional elements recovering the physical and chemical properties of the soil and finally raising the plants' function in this pavement.This factor can also produce the biological composts in the nature. The strong attention of the advanced countries to these composts is to produce the biological composts; however they have to pay roughly attention to the side effects of these chemical composts environmentally. The Iranian borage (Echium amoenum) is a multi-annual plant originating from the family Boraginaceae [4]. It has flavonoid, Saponini and Phenolic compositions [9]. In the recent years, being ensure of producing the most sustainable food productions and healthy nutritional ingredients is one of the most important factors environmentally regarding to the different sciences such as agriculture, ecology and environment. This process has been also paid attention by agriculturists, researchers, officials and politicians strongly [12]. Vermin-compost includes nutritional materials being required for the whole plants including nitrogen, phosphorous, potassium, calcium, magnesium, sulphur, iron, manganese, cooper, burr and zinc. This also includes the positive effect in nutrition of the plant, photosynthesis and chlorophyll of the leaves increasing the nutritional materials and nutrients of the different parts of the same plant such as stem, stalks and fruits potentially. The high percent of the Humic acid in the vermin-compost can assist on the health of the plant increasing the phenolic combinations such as Antocianins and Flavonoids as well as raising the function and quality of the plant preventing any diseases and vegetarian infections [15]. Bio-super or biological super-phosphate include the Apatit stone, sulphur and oxidizing bacteria of the sulphur originating

Corresponding Author: Hassan Nourafcan, Department of Horticulture, Miyaneh branch, Islamic Azad University, Miyaneh, Iran.
E-mail: hassannourafcan@gmail.com

from Tiobacilius or in other cases of the golden combinations of bio-phosphate are composed of phosphate stone, sulphur, chemical material as the incubation of the Tiobacilius along with zinc [5]. Many soil-living micro-organisms are able to produce and secret the organic acids particularly ketogloconic, citric, alzalic, malic and sucsinic in the solubility of the mineral phosphates effectively. In addition, many of these materials can produce phosphates enzymes causing to release the phosphorous from the organic compositions. It is natural that these micro-organisms have different influential intensity based on their type and degree of the solubility materials. The solubility microorganisms can actively get colonized in the stem (Risosphere) as saprophit consuming the insolubility phosphate compositions of the stem such as tri-calcium phosphate making the plant to intake the same material. These microorganismsare effective in producing and secreting the organic acids such as Malic, sucsinic, Piropionic, Lactic, Sitric, Ketoglonic and mineral phosphates. In addition, many of these minerals cause to release the phosphorous by producing the phosphatase enzyme. The used bacteria Bacillus, Aspergillues and Pseudomonas are existed in this case [1].

METHODS AND MATERIALS

The related land is determined and then it is cultivated in autumn. Simultaneously, with the autumn cultivation the collapsed vermin compost is given to the soil by 10ton in hectare. In early spring the surface cultivation is achieved and a disk is applied in order to provide suitable foundation for seed cultivation. The Looler is also applied to achieve surfacing operation. Due to the type of the cultivation as arrangement formation, the construction of these arrangements is also achieved in the determined distances. Every plot or patch includes four cultivation lines with 4m length and the distance between the arrangements is 50cm and the distance of the bushes is 50cm on the arrangements. The distance between the iterations is also 1m and the cultivation is achieved as handed-base formation. The depth of the cultivation is 1-2cm. the experimentation is achieved in the cultivation season in Meshkinshahr Town in 2012-2013. The sea level of the field is 1345m with longitude 40.68 and latitude 38.25. The annual degree of the precipitation is also 334.7mm. The main purpose of the present study is to investigate the effect of the vermin-compost, biological phosphate and their combinations on the function and effective materials of the borage in the framework of the accidental complete blocks in three iterations.The compost cares include observation (lack of using compost), vermin-compost 4ton in hectare, bio-super-phosphate 6lit in hectare, combination of vermin-compost 2ton in hectare and bio-super-phosphate 3kg in hectare. Every experimental patch includes 2*4m dimension. The quantity traits of the measured cases include the number and length of the stalk, number of flower in stalk, length of flower, length of leaf, and dry weight of flower (function per kg in hectare). The related data of the study is achieved by the use of SPSS15.0 using Duncan test method. There have been achieved some samples in order to prepare some information about the texture and type of the soil and then these sent to the laboratory to be analyzed. The results of the soil test have been given in table 1 as following.

Table 1: results of the experimental analysis of the soil sample (table of physical and chemical analysis of soil)

Depth of sampling by cm	Salinity (FC) ds/m	Ph	Saturation percent (SP)	Calcium carbonate (TCV) %	Organic carbon (OC) %	Total nitrogen (N)%	Intake phosphorous (PVa) PPM	Intake potassium (KaVa) p/PPM	Texture (TXE)	Zinc (Zn) mg/L	Ferrite (Fe) mg/L	Manganese(Mn) mg/L	Cooper (Cu) mg/L
-0.30	0.61	0.857	55	0.0819	0.321	0.120	8.6	144	Silt-Lumiclay	0.390	0.072	0.921	0.841

Table 2: results of the vermin-compost sample analysis (table of physical and chemical analysis)

Ferrite (Fe) PPM	Salinity (ECC) ds/m	Ph	Saturation percent (SP)	Calcium (Ca)%	Organic carbon (OC)	Total nitrogen (N)%	Phosphorous	Potassium (K)	Zinc (Zu) PPM	Percent of neutralizing materials	Percent of ash	Percent of organic materials	Percent of humidity
-2.5 1.5	2-2.5	7-7.9	100-115	3.8-4	17-20	1.3-1.6	1.5-2	0.9-1.5	340-350	13-15	50	35-40	5-10

In the beginning of growing season, the weeds were removed by the use of a crooked shovel to let leaves grow healthy. The daily flowers were also separately gathered and weighted separately. These flowers were dried in a room without exposing to the sun light on a clean cloth and kept into the cloth sacs. About 10g of these flowers were weighted for extracting operation and then they were grinded as powder by a grinder

machine and Ethanol by Sucsaile for making the same extraction operation. HPLC machine is also used to measure the degree of Rosmarinic acid of the borage.

Sample preparation:

A specified degree of Tozin extraction with 1000 mg/1 was injected into HPLC efficiently.

Analysis method:

Mobile phase: gradient of Methanol / Water with Trifluoroacetic-acid percent, fixed phase: reverse phase 18C and 25cm

Speed of the process: 1.2 ml / min, wavelength: 230 nanometer, machine specifications: Knuver Auto Sampler, Pumpe 1000, Detector PDA

RESULTS AND DISCUSSION

Analysis of the quality and quantity variance traits of borage:

The obtained results of the variance analysis have been given in table 3 for the related traits. Based on these results, the block effect did not show any significant differences on the related traits. The experimental cares for the traits of the stalk number, stalk length, length of flower, length of leaf, dry weight of flower and degree of Rosmarinic acid obtained significant probability in 1 level and the number of the flower showed this significance level in 5% between the experimental cares. The change variances (CV) were low in the whole study traits showing the acceptable accuracy of the experiments with the lowest experimental error (table 3).

Correlation of the under-study traits in borage:

The trait of the number of flower, length of leaf and dry weight of flower have positive significant correlation with the number of stalk and the trait of the leaf length has a positive significant correlation with the degree of Rosmarinic acid in 5% probability level (table 4).

Table 3: variance analysis of the measured quality and quantity traits in borage

Quantity traits				Quality traits				
Change resources	DF	Number of stalk	Length of stalk	Number of flower	Length of flower	Length of leaf	Dry weight of flower	Rosmarinic acid in 1000ml
Iteration	2	0.109ns	4.682ns	0.647ns	1.362ns	0.887ns	13.39ns	299289760.66ns
Care	5	0.402**	241.42**	271*	0.23**	0.64**	0.65**	0.9**
Experimental error		0	241.42	0.4	33	60	5927	66641831951800
	10	0.061	4.037	0.2411	2.482	2.207	593.722	615135804.06
Coefficient of changes (%)	3.24	2.4	6.7	6.71	6.10	5.05	0.6	

Table 4: variance analysis of the under-study quality and quantity traits in borage

	Number of stalk	Length of stalk	Number of flower	Length of flower	Length of leaf	Dry weight of flower
Length of stalk	0.421					
Number of flower	0.8150*	0.621				
Length of flower	0.794	0.295	0.807			
Length of leaf	0.882*	0.606	0.696	0.539		
Dry weight of flower	0.852*	0.498	0.862*	0.592	0.877*	
Rosmarinic acid	0.754	0.117	0.469	0.456	0.682*	0.766

Table 5: variance analysis of the measured quality and quantity traits in borage

Measured traits							
Experimental cares	Number of stalk	Length of stalk	Number of flower	Length of flower	Length of leaf	Dry weight of flower	Rosmarinic acid
Observation	8.067c	72.333c	14.600b	17.533b	18.000b	422.000c	0.001276298d
Vermin compost	8.067a	77.933b	17.067a	26.067a	29.333a	527.667ab	33.13002620.33a
Bio-super-phosphate	7.467b	77.933b	16.80a	26.333a	19.600b	454.000b	0.001558239b
Vermi compost+ bio-super-phosphate	7.867ab	92.733a	18.267a	24.533ab	27.133ab	539.000a	

*means having common letters in every column do not have significant difference in 5% according to the minimum significant difference (LSD).

Discussion:

Among the investigated cares of the study, cares having vermin-compost have the highest number of stalks. In another study carried out on the matricaria, it is shown that the consumption of the vermin-compost with recovering the soil structure or texture can increase the height of the related matricaria plant [7]. The combination of the vermin-compost and bio-super-phosphate had the highest effect on the length of stalk. In relation to the effect of the solvent microorganisms of phosphate on the pharmaceutically plants, Ratti et al in their study on the Cymbopogon Martini observed that the solvent bacteria of phosphate increased the height of the bush and vegetarian biomass in compare to the observation group [13]. In relation to the number of flower except the observation group the rest of the cares were established in class A. in experimentation, it is reported that the consumption of the organic compost in milfoil or yarrow increased the production of the biomass and percent of the extraction [2]. The observation group had the lowest length of flower. Falahi et al [8] in a similar study observed that the quality and quantity function of the matricaria increased under the effect of the phosphate solvent bacteria. The cares having vermin compost had the highest length of leaf and the observation group with bio-super-phosphate had the lowest length of the leaf. Tahami et al [3] by investigating the effect of the organic and chemical composts on the sweet basil showed that the plants under the vermin compost care have the highest bush height, leaf function, the aerial parts of the wet and dry function in compare to other cares. The cares having vermin compost had the highest dry weight of flower. In a study the application of the bio composts of Aztobacter, Azosprilium and Bacillus can increase the growth, weight and the degree of the extraction among the medication plants regarding to the fennel [11]. The vermin comost has the highest degree of rosmarinic acid and the observation has the lowest degree of the same acid among the experimental cares. In relation to the role of bio-composts on the quality and quantity of the fennel extraction (Kapoor et al, 2004) showed that the biology of the fennel stem with two species of fungus named Vesicular Arbuscular and Mycorrhiza = VAM can significantly increase and recover the degree of the extraction and its quality so that the degree of the same material (Anthol) can increase in compare to the observation group but the degree of Fenkon and Limonen will be reduced in this regard.

The results showed that the compost cares has the significant effect on the number of stalk, number of flower, length of flower, length of leaf and dry weight of flower (table 5). According to the obtained results the biological compost of bio-super-phosphate had the positive significant effect on the measured traits and the highest effect is subjected to the length of flower and dry weight of flower. The facilitating bacteria of phosphate that the Soudonomos and Bacillius are the main important species are able to produce and secret the organic acids with their own mechanisms particularly 2-ketooxalic, Citric, Malic and Sucxinic and other mineral phosphates efficiently. In addition, many bacteria producing the Phosphatase enzymes can release the phosphorous from the phosphorous organic combinations [6]. The vermin compost care and combination of the vermin compost and bio-super-phosphate had the highest effect on the measured traits. Due to the useful effects of the organic materials on the physical and chemical features and biological issues of the soil (fertilization of the soil), they are considered as one of the most essential foundations of the soil fertilization in this pavement. The organic composts can increase the soil organic materials recovering the chemical features of the soil such as Ph, cationic interaction capacity and increase the microorganism activity and the degree of nutrients accessibility fertilizing the soil efficiently [14]. In terms of the degree of rosmarinic acid the vermin compost cares and the combination of the vermin compost and bio-super-phosphate had the highest effect in compare to cares without any increase of rosmarinic acid. Due to the obtained results, it is specified that the compost cares had the highest effect on the quantity features of the borage significantly and the effect of the type of the bio-phosphorous composts and vermin compost is different on the quality of borage.

Conclusion:

Generally the results of the present study showed that by the use of optimized biological issues (bio-super-phosphate and Nitroxin) mitigate and lessen the contamination issues along with the agricultural affairs. The application of the vermin compost had the significant effect on the borage qualitatively and quantitatively. Therefore, by the use of the vermin compost, it can reduce the environmental contaminations and pollutions instead of chemical materials potentially.

REFERENCES

[1] Akbari, G.A., A.A. Dadi, S.H. Dashti And H.A. Alikhani, 2011. microbiology of soil, microorganisms and growth of plants, university of Tehran, publication institution

[2] Akbarinia, A., A. Ghalavand, F. Sefidkon, Z. Tahmasebi, A. Sharifi and M. Rezaiee, 2002. investigation of the function and effective material of ZENIAN in the agricultural systems. Abstract articles in 7th conference of agricultural sciences of Iran, research institution of the seed amendment center, Karaj, p: 52.

[3] TahamiZarandi, M.K., P. RezvaniMoghadam and M. Jahan, 2010. comparison of the organic composts effect and chemical issues on the function and percent of extraction of medication plants of sweet basil (OcimumBasilicum L.). agriculture magazine, 12): 70-82.
[4] Davazdah Emami, S. and N. Majnoun Husseini, 2008. agriculture and cultivation of medication plants, chapter, 4: 138-145.
[5] Sarikhani, M.R and M. Ebrahimi, 2010. phosphate biological composts and micoriz fungus, the first conference of the compost challenges in Iran, magazine of water and soil, (1)18: 23-37.
[6] Saleh Rastin, N., 2001. biologic composts and their role in sustainable agriculture, magazine of water and soil for biological composts, 23: 19-23.
[7] Azizi M rezvani, F., M.H. Khayat, A. Lezkian and H. Nemaati, 2008. investigation of the different surfaces of the vermin compost effect and irrigation on the morphological traits and degree of Dutch Matricariawith Goral cultivar. Magazine of medication plants of Iran, 1(24): 82-93.
[8] Falahi, J., A.A. Kouchaki and Rezvani P. Moghadam, 2009. investigation of the biological composts effect on the quality and quantity function of the Dutch Matricaria, magazine of agricultural and cultivation issues of Iran, 1(7): 127-135.
[9] Nederi Haji BagherKandi M and M.B. Rezaiee, 2004. investigation of borage (EchiumAmoenum) photo-chemical features. The Iranian aromatic and medication plants researches, (3)20: 377-384.
[10] Kapoor, R., B. Giri and K.G. Mukerji, 2004. Improved growth and essential oil yield and quality in *foeniculumvulgare* Mill on mycorrhizal inoculation supplemented with P-fertilizer. Bioresource Technology, 93: 307-311.
[11] Mahfouz, S.A. and M.A. Sharaf-Eldin, 2007. Effect ofmineral vs. biofertilizer on growth, yield, andessential oil content of fennel (*Foeniculumvulgare*Mill.). International Agrophysics, 21: 361-366.
[12] Neeson, R., 2004. Organic Orocessing Tomato Production. first edition.
[13] Ratti, N., S. Kumar, H.N. Verma and S.P. Gautam, 2001. Improvement in bioavailability of tricalciumphosphate to *Cymbopogonmartinii* var. *motia* by *rhizobacteria*, AMF and *Azospirillum* inoculation.Microbiological Research, 156: 145-149.
[14] Renato, Y., M.E. Ferreira, M.C. Cruz and J.C. Barbosa, 2003. Organic matter fractions and soil fertility under influence of liming, vermicopmpost and cattle manure. Bioresource Technology, 60: 59-63.
[15] Theunissen, J., P.A. Ndakidemi and C.P. Laubscher, 2010. Potential of vermicompost produced from plant waste on the growth and nutrient status in vegetable production. International Journal of the Physical Sciences. 5(13): 1964-1973.