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Consequence of Gibberellic Acid and Vermicomposting on Vegetative Development, Mineral Content and Features of Persian Shallot: allium Hirtifolium bios, Tarom region, Mazandaran

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Abstract

Persian Shallot (Allium hirtifolium boiss) is a valuable medicinal plant that is native to Iran. This herb belongs to the Alliaceae family and a perennial herb. This research was conducted to investigate the effect of vermicompost and gibberellic acid on vegetative growth, mineral content and characteristics of Allium bulb. The results of this study showed that the highest level of leaf area (19.12 cm2) was related to 0.7 kg/m2 and (21.66 cm2) treated with 206 ppm of gibberellic acid, the most number of leaves (4.95) in the treatment of 410 ppm gibberellic acid, the most number of daughter bulb were (7.36), respectively, for treatment of 1.2 kg/m2 vermicompost and (7. 24) for 410 ppm treatments Gibberellic acid, the highest diameter of daughter bulb (10.82 mm) was related to 0.6 kg/m2 vermicompost treatment, the highest dry weight of bulb (1.92 gr) was 0.7 kg/m2 vermicompost, highest percentage bulb's dry content (32.93%) was related to 1.2 kg/m2 vermicompost treatment and (33.72%) was related to 410 ppm of gibberellic acid, the highest amount of phosphorus (0.37%) was related to the treatment of 410 ppm gibberellic acid and the highest amount of potassium (1.92%) was related to 1.2 kg/m2 vermicompost treatment.

Introduction

Garlic is one of the spread harvests which have a worldwide status in positions of sensitivity and feature. Zanjan domain produces 25 percent of total garlic yield of Iran and is one the centers of garlic production in the nation (Greenberg-Kaslasi, D. 1991). Operative components on advertising of garlic are not fine considered in this domain (Farooq, S., 1983). Consequently, the foremost determination of this revision is examination of components impacting advertising of garlic in zanjan province (Gharneh, H. A. A., 2015). Information was composed over a survey rationality of which was accepted by a piece of skilful and its dependability was dignified by calculating cronbach' salpha components (a = 0.83) (Gercekcioglu, R., 2007). The arithmetical population of this revision contained of garlic farmers of Zanjan domain (P = 1350) amongst which 119 farmer were designated over stratified comparative specimen (Jaleel, C. A., 2007). Consequences exposed that consumer consummation and harvest superiority were operative on advertising of garlic) Szentmihályi, K., 2002; Tramorto, J. R. S., 2010). Additionally progression examination presented that inconstant of domestic dimensions, agriculturalists' information, agronomic knowledge, stage, zone of educated terrestrial and the quantity of facilities or processes have completed on garlic had an important consequence on garlic advertising problems (Gantait, S.,2010). Progression examination for the additional reliant inconstant i.e., value of garlic on extensive purchasers' focus on exposed that garlic assembly price, marketplace concerned with advertising, the cost dispensation garlic, opening finances and entire occurrence of garlic are meaningfully actual on this flexible (Aherne, S. A., 2002). Synopsis: Indigenous plants are considered the most important plant species of any country (Jalili, H., 2008). Because with the disappearance of these species they will extinct forever (Halliwell, B., 1993). Amongst the important medicinal endangered species in Zanjan (Tarom City) province there is Persian shallot (Allium hirtifolium Boiss) that is one of the exclusive plants in Iran with many usages in medicine and food industries(Kazaz, S.,2009; Rezvani, M. P.,2014). Persian shallot is totally different from foreign shallot (Baccouri, O., 2006; Tognetti, C., 2005).

These two plants have distinct difference in terms of origin and natural habitat, so that the Persian shallot originated from mountainous and cold regions, while the foreign shallot in tropical regions of East Asia and mainly cultivated in tropical regions of Europe (Farjadian, A. M., 2013; Subler, S., 1998). Persian shallot is from alliaceae family and grows in Alborz Mountains as a wild plant. This kind with more than 800 species considered as the biggest monocots (Arancon, N. Q., 2004A). One of the main points in allium evolution is in Persian-Torani region. Shallot is a perennial, herbaceous and aromatic plant consisting of one perpendicular full floral stalk without leaves reaching 82 to 125 cm (Hanks, G. R., 1984). Each shallot bush has 7 to 9 leaves (Brand-Williams, W., 1995). Shallot flowers are pink or carmine and usually fruitless and they are in complex flower convex umbrellas (Asili, A., 2010). This plant has a tissue similar to onion, yellow, egg-shaped and has a white shell (Joint, F. A. O., 2010; Man, R. S., 2010). Shallot is a plant that is resistant to cold and for surviving it should pass a winter period. Proper temperature for growing shallot is 6 to 27 degree Celsius. Shallot plants are well settled in heavy and semi-heavy soils and prefer alkaline soils and grow well at pH 4.7 to 8 (Benkeblia, N., 2007). Onion herbs are rich sources of anti-oxidant and valuable substance like vitamins A,B,C,D, linolenic acid (omega 3), linoleic acid (omega 6), sulfur compounds such as disulfide and tri-sulfide and minerals such as potassium, sodium, calcium, magnesium, phosphorous, copper, zinc, iron and beta carotene (Astaraei, A. R.,2006; Lee, S. Y.,2009). The most important species in allium kind are shallot, garlic, onion, chives and leek (Balasundram, N., 2006). Amongst medicinal properties of Persian shallot there are bactericidal, anti-fungal, anti-virus, rheumatism treatment, skin scarring treatment, neurological disorders, gout, arthritis, diarrhea, indigestion, hemorrhoid and sudorific, expectorant, antibiotic and anti-spasmodic, diabetes treatment, cold, stress, fever, cough, headache, asthma and cancer (Baseri, R., 2015 Takahashi, K., 1973). Phosphorus is an essential ingredient in metabolic activities and bone structure (Atiyeh, R. M., 2002). Phosphorus is an important element in the composition of adenosine triphosphate and nucleic acids; it is also an essential element in the regulation of acid and base balance, bone and teeth. One of the organic materials is vermicompost that is important due to its properties such as high porosity, the ability to absorb and maintain mineral elements and gradually liberate them and high water holding capacity (Bianchini, F.,2001; Lima, G. P. P.,2014; Pritchard, F. M.,2000). Vermicompost contains macro elements such as nitrogen, phosphorus and potassium and micro elements such as iron, copper, zinc and manganese and also substances such vitamin B12 and Auxin. Usually the C / N ratio of vermicompost is 22-17 and its humus is 22% dry weight (Bharti, N., 2016; Nazarideljou, M. J., 2014). The main advantages of vermicompost in comparison to conventional composting are: Lack of bad and unpleasant smell and high CEC, low EC, balanced PH, high absorbance of elements such as P, N and K. Gibberellins belong to a large group of natural compounds called Terpeneids (Anderson, G. J., 1990). The moulonic acid route is used for gibberellin biosynthesis. The most famous gibberellin Is Gibberellic Acid (GA) (Hashemabadi, D., 2010; Ruxton, C., 2007). The basic building of all the gibberellins is made from 4 loops that have been interconnected and made up of gibberellic loops. Each gibberellin molecule consists of 20 to 21 carbon, 23 to 29 hydrogen atoms and 5 to 10 oxygen atoms. The only common feature of all Gibberellins is the presence of the COOH group (Fang, Z., 2009). Gibberellic acid hormone is very effective in the transfer of reserve compounds, especially the accumulation of organic matter in the gland, the growth of tubers and onions of plants and the production of secondary metabolites of

plants (Bravo, 1998). This research was carried out with the aim of investigating the effect of gibberellic acid and vermicompost fertilizer, as well as its interaction on vegetative growth, mineral content and characteristics of Persian shallot (Arancon, N. Q.,2004B; Kurtar, E. S.,2005). Tarom County is a county in Zanjan Province in Iran. The capital of the county is Ab Bar. At the 2006 census, the count"s population was 42,939, in 10,734 families (Rezvani Moghaddam, P., 2017). The county was subdivided into two districts: The Central District and Chavarzaq District. The county contains two cities: Chavarzaq and Ab Bar (Heldt, H. W., 1997; Mohammadi, J., 2010).

Materials and Methods

This experiment was conducted as a factorial based on randomized complete block design with 3 replications and 28 treatments in Tarom in the field of research in crop year of 2016-2017. The treatments included combined and separate effects of gibberellic acid hormones (in 3 levels: Control (without any hormones), 210 and 410 ppm) and vermicompost fertilizer (in 3 levels: Control (without any fertilization) and 6/0 and 1.2 kg/m^2) (Soetan, K. O., 2010; Szentmihályi, K., 2002; Umrao, V. K., 2007). Prior to conducting the research, random sampling was carried out from the soil of this land, the results of which were analyzed in Table 1 (Huang, D., 2005). The fertilizer required for this experiment was obtained from the Vermicompost Fertilizer Center of Zanjan and the Golden Worm Company. The results of Vermicompost fertilizer analysis on field use are described in Table 2 (Jennings, W., 1997). The effects of treatments on measurement attributes and result of means comparison mentioned on Table 4.

The land preparation steps included primary plowing at a depth of 32 cm from the ground, fertilization at a depth of 22-32 cm, the leveling of the land and forming an aqueduct and bank before planting in early November. Each test plot with dimensions of 2 × 1 (two square meters) was created. Plot spacing was 0.6 m and the depth of onion was 11 -6 cm (Das, 2000; ılıçgün, H., 2010; Pogroszewska, E., 2007). Before planting, the bulbs were first placed in a refrigerator for 48 h at 5°C. Then, after washing with lukewarm water, it was disinfected with chlorrex 11% for 62 seconds (Hussaini, A., 2013; Nematollah, E., 2011). On sowing day, before transferring bulbs to the main ground, dissolve 0.22 grams and 0.42 grams of gibberellic powder in a small amount of 97% ethanol (97 mL of ethanol and 5 mL of distilled water), distilled water with a volume of 1100 cc and bulbs For 5 h, they were immersed in a stock solution made with a specific concentration and then transferred to the original ground (Ebrahimi, R., 2009; Pritchard, F. M., 2001). All around the orlon was covered with foil to prevent light passing through and breaking down the hormone. Distilled water was used alone for control treatment (Azadi, H. G., 2009; Sabur, M., 2013). The first soluble spraying on leaves and behind the leaves of shallot was carried out on March 27th in the afternoon and was repeated uniformly in two steps with intervals of 17 days. Planting operations were carried out on November 10, 2010 (Ercisli, 2007; Safaei, M., 2009). The first irrigation was carried out immediately after cultivating shallot bulb simultaneously in all plots and after that, till April, 2018, due to seasonal rainfall, irrigation was not done. Irrigation was carried out once a week from April to the following day (Dehdashtizadeh, B., 2009; Olsen, S. R., 1982). The last irrigation was carried out simultaneously with the start of plant drying (3 weeks before harvesting). Harvest operation with

complete drying of the growing organs and ensuring the discharge of food from leaf to bulb was done on June 22, 2018.

Elevating Vegetative, Reproductive and Mineral Elements

To measure the traits, 9 plants per plot were randomly selected and all traits were measured on these 9 plants (Pratt, P. F., 1982). During this experiment, main growth indices such as: Leaf number average, leaf area index, average number of female bulbs, mean diameter of mother and daughter bulb, average fresh weight of mother and female bulb, dry weight of bulb and dry matter percentage of bulbs were as follows Measured and evaluated (Ozcan, M.,2002).. Leaf area is a key variable for physiological studies. At the end of plant growth, from each plant, three leaves were selected and their leaf area was measured. To determine leaf area index, a Leaf Area Meter was used on a square centimeter scale. To count the number of leaves per plant, at the end of vegetative growth and the emergence of the last leaf per plant, the number of leaves in 9 plants was counted and averaged. Measuring the fresh weight of the mother and baby onion by a scale with a precision of 0.02 grams per gram (Cakmak, 2000). Calculation of the dry weight of onions was done after layering the onions, placed them in an oven at 72°for 48 h and, after drying, was measured and scored by a scale of 0.02 g / g. Measurement of the diameter of mother and daughter onions was carried out on the thickest part of onion and measured by caliper with a precision of half a millimeter (Das, 2000; Taran, M., 2010). In order to measure the amount of phosphorus and potassium in the bulb, the method of drying in an electric furnace was used. For phosphorus, UV spectrophotometer devices with a wavelength of 864 nm) and for potassium Flame photometer (Flame Meter was used and calculated (Ebrahimzadeh Abdashti, R., 2016; Normanly, J., 1995). Analysis of the data was analyzed using SAS software. The Excel software was used to draw charts and tables. For comparing the averages, the LSD method was compared to the 7% probability level (Azadi, H. G., 2008; Li, Q. Q., 2010).

Results and Argument

Results of analysis of variance significant that between applied treatments in all desired traits of shallot, from statistical point of view in five percent level, shows us there is a significant difference in it. (Table 3) (Rizek, D. T.,1998).

Number of Leaves and Leaf Area

Result of means comparison showed that, most leaf area goes to treatment 0.6 kg (Vermicompost) compost and the case 210 ppm Gibberellic acid. Generally gibberellins in different levels of growth, have different effects on different plants in growing (Mendoza-Hernández, D., 2014; Vithatran, S. T., 2004). The gibberellin treatment in high consistency, amplifies growing of some plants leaves that confirms result of our resources. Also, these results showed that the greatest number of leaves belonged to treatment with

1.3 kg/m2 [vermicompost compost. After that, the treatment with 410 ppm gibberellic acid and less of them (with 3.72 leaves) belonged to treatment with no gibberellic acid and after that the treatment (with 4.14 leaves) by no compost. There are many reports in case of positive effect of gibberellic acid in growing parameters including leaf number and the length of leaves .The treatment of big onions with gibberellin provides most number of leaves and in negative case of small onion treatments with gibberellin, decreases the number of leaves that confirms the other result of researchers.

Fresh Weight of Mother and Daughter Onion

Result of means comparison of treatments showed that most weight of mother and daughter union upon treatment 0.7 kg/m^2 (vermicompost). Most weight of mother onion upon treatment with 210 ppm gibberellic acid (according to chart no. 4). This result confirmed by other research results. This result also showed that most weight of daughter union upon treatment 0.7 compost and after that treatment with 200 ppm gibberellic acid separately, that confirmed with other result of researches. Also less weight of daughter union upon 1.92 g treatment with no compost, 2.10 g treatment with no hormone (according to chart no.4). Generally gibberellic acid has positive effects on union flower growing.

Calibrate of Daughter and Mother Onions

Result of means comparison showed that the most calibrate of mother and daughter unions upon treatment 0.6 kg/m^2 compost and most of mother union calibrate upon treatment 210 ppm gibberellic acid and most calibrate of daughter union upon 410 ppm gibberellic acid (according to chart no.4). Between gibberellic acid and union size, there is s interaction.

Number of Daughter Onion

Result of means comparison of every treatment of compost and hormone showed that the most number of daughter union upon 1.1 kg/m2 (vermikepust) compost and treatment with 410 ppm gibberellic acid that confirmed with other results of researches.

Dry Weight of Onion

Result of means comparison showed that most dry weight of union upon 0.6 kg/m^2 (vermikepust) compost. And also there is significant difference in two levels of 210 and 410 ppm gibberellic acid on dry weight of union (Kudsen, D., 1982).

Dry Material Onion Percentage

Result of means comparison showed that most dry material union percentage upon 1.2 kg/m2 (vermicompost) compost and 410 ppm hormone. Results of this research confirmed with other

researches (Taylor, M., 2003).

The Amount of Phosphorus

Result of means comparison showed that the most amount of phosphorus upon treatment 0.6 kg/m2 (vermicompost) compost and 410 ppm gibberellic acid. But between two treatments without hormone and 210 ppm gibberellic acid there is a significant difference in 5.2 percent level (according to chart no.4). This result confirmed. Generally, (vermicompost) includes materials like calcium, phosphorus, potassium, sulfur, magnesium and low consumption elements that gives plant possibility to provide absorption of nitrogen phosphorus and potassium (Klute, A., 1986).

The Amount of Potassium

Result of means comparison showed that the most amount of potassium upon treatment 1.2 kg/m2 (vermicompost) compost that confirmed with. Generally vermicomposting effectively includes decreasing dirt’s PH and increasing phosphorus potassium, calcium and magnesium.

Generalization

Based on the results of this researches it seems that Persian-Iranian shallot adjusts with Iran's weather specially Zanjan's. using bio fertilizers like (vermicompost) in addition to providing food elements for plants and increasing their quality, can be useful instead of using chemical compost specially composts with heavy texture and clay, in humid areas, so it has no harmful effect on user health. Also using gibberellic acid hormone boosts growth of unions' size and increasing onions dry matter, increasing number of daughter union and increasing number and leaf area. Therefore with due attention to this research result using gibberellic acid hormone and vermicompost fertilizer recommended.

Conclusions and Results

The results of this study showed that the highest level of leaf area (19.12 cm^2) was related to 0.7 kg/m^2 and (21.66 cm^2) treated with 206 ppm of gibberellic acid, the most number of leaves (4.95) in the treatment of 410 ppm gibberellic acid, the most number of daughter bulb were (7.36), respectively, for treatment of 1.2 kg/m^2 vermicompost and (7. 24) for 410 ppm treatments Gibberellic acid, the highest diameter of daughter bulb (10.82 mm) was related to 0.6 kg/m^2 vermicompost treatment, the highest dry weight of bulb (1.92 gr) was 0.7 kg/m^2 vermicompost, highest percentage bulb’s dry content (32.93%) was related to 1.2 kg/m^2 vermicompost treatment and (33.72%) was related to 410 ppm of gibberellic acid, the highest amount of phosphorus (0.37%) was related to the treatment of 410 ppm gibberellic acid and the highest amount of potassium (1.92%) was related to 1.2 kg/m^2 vermicompost treatment.

Declarations

COI SFTATEMENT

Availability of Data and Materials

Some or all data, models, or code generated or used during the study are available from the corresponding author by request.

Conflict of Interests

There is no conflict of interest.

Ethical Approval

The present Study and ethical aspect was approved by Department of Civil Engineering, School of Engineering, American University in Dubai, Dubai, P. O. Box: 28282 United Arab Emirates

Consent to Participate

KOAA and HG designed the study, collected data, wrote the manuscript and revised it.

Consent to Publish

KOAA and HG agree to publish this manuscript. There is no conflict of interest.

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Competing Interests

There is no competing of interest.

Author's Contributions

KOAA and HG designed the study, collected data, wrote the manuscript and revised it.

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