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SIIRT UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY

THE EFFECTS OF DOSAGES OF VERMICOMPOST AND NP ON PLANT GROWTH AND NUTRIENT CONTENT OF HYACINTH (*Hyacinthus* sp.) IN ECOLOGICAL CONDITIONS OF SİİRT

MASTER DEGREE THESIS

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THESIS ACCEPTANCE AND CONFIRMATION

The thesis study entitled "The Effects of Dosages of Vermicompost and NPK on Plant Growth and Nutrient Element Contents of Hyacinth *(Hyacinthus* sp.) in Ecological Conditions of Siirt" prepared by Sirwan Rashid Ali has been accepted as a Master Degree Thesis with unaminity votes by the following jury on the date of 15/12/2017 at Siirt University, Institute of Sciences, Department of Horticulture.

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I confirm the above conclusion.

Assoc. Prof. Dr. Koray ÖZRENK
Director of Institute of Science y.

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DECLARATION PAGE

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Sirwan Rashid ALI

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PREFACE

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ABBREVIATIONS AND SYMBOLS

Abbreviation	Statement
LSD	: Least Significant Difference
Max	: Maximum
Min	: Minimum
pH	: Power of Hydrogen
SAS	: Statistical Analysis Software
N	: Nitrogrn
K	: Potassium
P	: Phosphorus
Fe	: Iron
Ca	: Calcium
Cu	: Copper
Zn	: Zinc
Mn	: Manganese
Mg	: Magnesium
HA	: Humic acid
RDF	: Resoure Description Framework
PSB	: Phosphate Solubilizing Biofertilizer
FYM	: Farm Yard Manure

Symbol	Statement
cm	: Santimeter
g	: Gram
mm	: Milimeter
%	: Percent
α	: Alfa
°C	: Santigrat
t/ha	: Tone per hectar
kg/ha	: Kilo gram per hectar

ÖZET

YÜKSEK LİSANS TEZİ

SİİRT EKOLOJİK KOŞULLARINDA SÜMBÜL (*Hyacinthus* sp.) BİTKİSİNİN GELİŞİMİ VE BESİN ELEMENTİ İÇERİĞİ ÜZERİNE VERMİKOMPOST VE NP DOZLARININ ETKİLERİ

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Bu çalışma 2016-2017 yılları arasında Siirt Üniversitesi’nde yürütülmüştür. Çalışmada sümbüle (*Hyacinthus orientalis* L. “Purple Star”) 25 g/soğan (V1), 50 g/soğan (V2) ve 75 g/soğan katı solucan gübresi (vermicompost) ile 2 kg/da (NP1), 4 kg/da (NP2) ve 8 kg/da (NP3) azot-fosfor (NP) gübreleri uygulanmıştır. Çalışmanın sonunda bitki gelişimi ile yapraklardaki ve soğanlardaki besin elementi içeriği ortaya koyulmuştur.

Bitki gelişim kriterleri sonuçlarına göre, ilk çiçeklenme zamanına ait en yüksek ortalama 136,35 gün, küme çiçe 138,38 gün, hasat zamanı 140,92 gün kontrol uygulamasında; yaprak sayısı 5,710 adet, yaprak uzunluğu 128,28 mm, floret çapı 28,140 mm, sap kalınlığı 13,507 mm V1; çiçek çapı 66,96 mm V2; çiçek boyu 116,33 mm, floret sayısı 37,690 adet, floret boyu 26,768 mm, yaprak çapı 28,86 mm ve bitki boyu 179,547 NP3 uygulamalarında elde edilmiştir.

Yaprak analiz sonuçlarına göre, kalsiyum (Ca) ve magnezyum (Mg) içerikleri (sırasıyla 0,775-1,130 % ve 0,239-0,346) hariç azot (N), fosfor (P), poatsyum (K), demir (Fe), mangan (Mn), çinko (Zn) ve bakır (Cu) içerikleri sırasıyla % 2,403-4,450, % 0,291-0,603, % 3,112-6,758, 802,333-1520,657 mg kg^{-1}, 46,253-86,200 mg kg^{-1}, 15,148-33,560 mg kg^{-1} ve 8,582-18,616 mg kg^{-1} istatistik olarak önemli bulunmuştur ($p<0,01$) Yapraklardaki en yüksek N, P, K, Mg ve Cu içeriği V3; en yüksek Zn içeriği V1; en yüksek Fe, Mn ve Ca içeriği NP3 uygulamalarında bulunmuştur.

Diğer yandan soğanlarda, N, Ca, Mg, Mn ve Cu hariç P, Fe ve Zn ($P<0,01$) ve K ($P<0,05$) içerikleri istatistik olarak önemli bulunmuştur. En yüksek N,P, K ve Mg içerikleri V3; Mn, Zn ve Cu içerikleri V1; Fe içeriği control ve Ca içeriği V3 ile NP2 uygulamalarında elde edilmiştir. Besin elementleri; N % 1,067-1,713, P % 0,191-0,337, K % 0,817-1,183, Ca % 0,287-0,372, Mg % 0,089-0,119, Fe 169,540-482,209 mg kg^{-1}, Mn 12,410-23,374 mg kg^{-1}, Zn 7,39-18,556 mg kg^{-1} ve Cu 4,711-6,949 mg kg^{-1} olarak tespit edilmiştir.

Anahtar Kelimeler: Azot-Fosfor gübrelemesi, besin elementi, bitki gelişimi, *Hyacinthus orientalis* L., Siirt, solucan gübresi, sümbül

ABSTRACT

MS THESIS

THE EFFECTS OF DOSAGES OF VERMICOMPOST AND NP ON PLANT GROWTH AND NUTRIENT CONTENT OF HYACINTH (*Hyacinthus* sp.) IN ECOLOGICAL CONDITIONS OF SİİRT

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This study was carried out on the campus of Siirt University between 2016-2017 years. Solid worm fertilization (vermicompost) at dosages of 25 g/bulb (V1), 50 g/bulb (V2), 75 g/bulb (V3) and 2 kg/da (NP1), 4 kg/da (NP2), 8 kg/da (NP3) Nitrogen-Phosphorus (NP) were applicated on plant growth and nutrient content of hyacinth (*Hyacinthus orientalis* L. "Purpe Star").

According to the results plant grwoth criteria, the highest mean on control treatment first flowering time 136,35 days; full flowering time 138,38 days, harvest time 140,92 days and the highest mean on V1; leaf number 5,710, leaf height 128,28 mm, floret diameter 28,140 mm, stalk thickness 13,507 mm; and the highest mean on V2; flower diameter 66,96 mm, and the highest mean on V3; flower height 116,33 mm and the highest mean on NP1; floret number 37,690 and the highest mean on NP2; floret height 26,768 mm, and the highest leaf diameter 28,86 mm and plant height 179,547 mm were obtained in NP3.

According to leaf analysis results, nitrogen (N), phosphorus (P), potassium (K), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) contents were found significant ($p<0,01$) statistically and between 2,403-4,450 %, 0,291-0,603 %, 3,112-6,758 %, 802,333-1520,657 mg kg^{-1}, 46,253-86,200 mg kg^{-1}, 15,148-33,560 mg kg^{-1} and 8,582-18,616 mg kg^{-1} respectively except calcium (Ca) and magnesium (Mg) contents were determined between 0,775-1,130 % and 0,239-0,346 respectively. In leaves the highest mean contents of N, P, K, Mg and Cu were found on V3 while Zn was found on V1 while Fe, Mn and Ca were found on NP3 treatments.

On the other hand, on P, Fe and Zn ($P<0,01$) and K ($P<0,05$) were found significant statistically, except N, Ca, Mg, Mn and Cu on bulbs. As well as the highest mean contents of N, P, K and Mg were found on V3 while Mn, Zn and Cu were found on V1; Fe was obtained on control and Ca was obtained V3 and NP2 treatments. The means of nutrient elements as N 1,067-1,713 %, P 0,191-0,337 %, K 0,817-1,183%, Ca 0,287-0,372 %, Mg 0,089-0,119 %, Fe 169,540-482,209 mg kg^{-1}, Mn 12,410-23,374 mg kg^{-1}, Zn 7,39-18,556 mg kg^{-1} and Cu 4,711-6,949 mg kg^{-1} were determined.

Keywords: Hyacinth, *Hyacinthus orientalis* L., Nitrogen-Phosphorus fertilization, nutrient element, plant growth, Siirt, vermicompost

1. INTRODUCTION

Hyacinthus orientalis L. is an herbaceous flower belonging to the hyacinth branch of the *Liliaceae* family (Hu et al., 2015). And it is a spring-flowering bulb and is a well-known cut flower (Abdulrahman and Kako, 2012). The individual flowers can also be used in the corsage, wedding arrangement, and perfume industry because an essential oil is extracted from its flowers for the manufacture of perfumes. As well as this flower with the Persian names "SINBOL” is also a popular garden and or pot plant. Hyacinth cultivars were forced under fluorescent lamps which emitted white, blue, green, yellow and red light (Dole and Wilkins, 1999). The plants started flowering in the first decade of February (Smigielska et al., 2014). This species was originally cultivated in the Mediterranean Region and South Africa (Hu et al., 2015). In 1562, it was introduced from Turkey to Eastern Europe. The genus of hyacinths consists of 30 species among which only *H. orientalis* have horticultural important due to make long- lasting cut flowers. As well as hyacinths generally grow between 10 and 30 cm tall and come in a wide range of colors. Flowers are usually between 15 and 20 cm tall. The swollen portion consists mostly of fleshy, food storing scales attached to a short flat stem. The plant prefers moist but light sandy to loamy soils. These soils could be acidic, neutral or alkaline. The dormant bulbs are fairly hardy and could withstand soil temperatures down to at least -5 °C (Matthews, 1994). Also this flower in natural conditions, adventitious bulbs develop at the base of the mother bulb. They are small and they start to bloom firstly after 2-3 years of cultivation. Hyacinths can be also reproduced by the planting of scales cut off together with a piece of mother bulb (Pierik and Woets, 1971; Krause, 1986). However, each of the above-mentioned methods results in a complete destruction of the mother bulb. This fact can be avoided by rooting and planting of leaves which will create adventitious bulbs (Smigielska and Jerzy, 2013) or by reproduction of hyacinth by in vitro cultures. However *H. orientalis* continuously improved thereafter, and it began to be cultivated in yards. In 1768, more than 2000 varieties of this species were recorded (Darlington et al., 1951). Nowadays, the common hyacinth cultivars used for gardening are Holland and Rome species (Hu et al., 2015). Because the famous flowering bulb is planted in the Autumn, the hyacinth is widely cultivated in pots and is used as a cut flower worldwide. Its fragrance and graceful style have provided this flower with considerable ornamental value. Also, in the Turkey populates many distinctive ornamental plant groups due to its location at the crosssection point of Mediterranean, Europe-Siberia and Iran-Turan phytogeographical regions and different climatic conditions prevalent in its region, which cause natural floristic richness, biological difference and several habitat characteristics which cannot be seen in many countries. Flower cultivation, which has a large natural potential in Turkey, is gradually growing importance and become a productive agricultural and commercial branch. Cut flower cultivation is a development of ornamental plant production having the largest part either in production or economic value. Cut flower production includes the processes, where fresh or dried flowers or their parts are used in clamps and arrangements in its original or colored forms. Activities such as growing, choosing, procession, classification, storing and marketing of flowers are included in the cut flower production process (Sönmez et al., 2013). Nearly 50 countries produce a cut flower. Turkey is among the most important countries having the largest potential for cut flower growing with its climatic and topographical characteristics. The largest cut flower growing centers are the centers of Yalova, İzmir, and Antalya in the country. Over the half of the area rest for ornamental plants in the country is divided for cut flower production. Two-thirds of more than 9500 ha area divided for cut flower production is in the greenhouse. However, thirty percent of cut flower production in Turkey is cultivated under open condition. It is expected that Turkey shares 0,7 % of all ornamental plant growing amount in the world (Akpinar and Bulut, 2011). Generally, farmers use chemical fertilizers to improve soil fertility and hence increase the yield of their crops. However, the use of chemical fertilizers causes a great impact on the soil quality and the surrounding environment. Vermicomposting is a non-thermopiles and simple biotechnological process of composting, in which certain species of earthworms and microorganisms are used for biological degradation of organic waste (Arancon and Edwards, 2005; Khan and Ishaq, 2011). As well as vermicompost is usually a finely divided peat-like material with excellent structure, porosity, aeration, drainage and moisture holding capacity the nutrient content of vermicompost greatly depends on the input material. It usually contains higher levels of most of the mineral elements, which are in available forms than the parent material. Vermicompost improves the physical, chemical and biological properties of soil.

There is a good evidence that vermicompost promotes the growth of plants. Vermicompost has found to effectively enhance the root formation, elongation of stem and production of biomass, vegetables, ornamental plants etc. Nutrients in vermicompost are present in readily available forms for plant uptake; e.g. nitrates, exchangeable P, K, Ca and Mg (Chamani et al., 2008).

Sangwan et al. 2010 who inferred that soil amended with 30 percent vermicompost produced more number of flowers in marigold (*Tagetes erecta* L.). The plants were grown in pot culture experiments and the largest flower diameter was produced in soil amended with 40 percent vermicompost. Further, the beneficial effect of vermicompost might be due to increased soil organic matter and improved physical properties of soil like bulk density and better aggregation. Edwards and Burrows (1988) reported that vermicompost could promote early and vigorous growth of seedlings. Vermicompost has found to effectively enhance the root formation, elongation of stem and production of biomass, vegetables, ornamental plants etc. Also Chamani et al. (2008) studied the impact of vermicompost on the growth and flowering of *Petunia hybrida* 'Dream Neon Rose' in greenhouse conditions using 0, 20, 40 and 60 % ratio of vermicompost and reported that vermicompost had positive, significant influence on the number of flower, leaf growth, and branch fresh and dry weights as compared to plants grown in vermicompost-lacking soil. Also, they stated that the highest yield was obtained from the treatment of 20 % vermicompost, the highest Fe and Zn amounts were obtained from the treatment of 60 % vermicompost and the lowest amounts were obtained from control. Also Kumari and Ushakumari (2002) reported that enriched vermicompost was a superior treatment for enhancing uptake of N, P, Ca and Mg by cowpea. And Edwards and Burrows (1988) reported that vermicomposts increased ornamental seedling emergence compared with those in control commercial plant growth media, using a wide range of test plants such as pea, lettuce, wheat, cabbage, tomato and radish however fertilizers are soil improvements applied to increase plant growth, the main nutrients added in fertilizer are nitrogen, phosphorus, potassium, other nutrients are added in smaller amounts.

Collectively, the main nutrients necessary to plants by weight are called macronutrients, including nitrogen (N), phosphorus (P), and potassium (K) (i.e. N-P-K). Ammonia is the main cause of nitrogen. Urea is the main product for making nitrogen available to plant.

Phosphorous is made available in form of superphosphate, ammonium phosphate. Muriate of potash (potassium chloride) is used for the supply of potassium. Artificial macronutrient fertilizer can be applied to as artificial or straight, where the product predominantly contains the three main nutrients. Compound fertilizers are N-P-

K fertilizers with other elements intentionally intermixed. Fertilizers are arranged according to the content of these three elements (Arancon and Edwards, 2005). Khan and Ishaq (2011) and Marschner (1995) stated that as well as improving nutritional administration is required to grow crops successfully on calcareous soils. Crops fertilizer management on calcareous soils differs from those of no calcareous soils due to the impact of soil pH on soil nutrient availability and chemical effects that affect the loss or fixation of some nutrients. Many studies have revealed that levels of available P, K and micronutrients are fairly low under calcareous soils conditions (FAO, 2005). Maximum fertilizers application for onion and cultivation of suitable cultivars under recovered calcareous soils are necessary for receiving good yield with the high quality of bulbs. The fundamental nutrients particularly, the primary macronutrients e.g. nitrogen-phosphorus-potassium (NPK) are necessary for plant growth, maturity, bulb yield, and quality. Bulbous plant is a heavy feeder of mineral elements. Organic fertilizers has positive effect on root growth by improving the root rhizosphere conditions (structure, humidity, etc.) and also plant growth is encouraged by increasing the population of microorganisms (Akpinar and Bulut, 2011). Nitrogen is an elemental part of chlorophyll. It is essential for the synthesis of proteins, enzymes and promotes healthy vegetative growth. Phosphorus and potassium play an important role in several key physiological processes viz. photosynthesis, respiration, energy storage (ATP, ADP formation), and improving the translocation of assimilates and protein synthesis (Marschner, 1995). Hence, for the economical probability of onion, the application of NPK fertilization in a balanced ratio is a prerequisite. Fertilizing plants causes them to grow more quickly and efficiently, just like securing a manufacturing plant has all the raw materials it needs for a production line. Fertilizers are required to produce out the best features of ornamental potted plants. For natural plants to grow and increase they need a number of chemical elements, but the most important are nitrogen, phosphorus, and potassium. Most packaged fertilizers contain these three macronutrients.

Nitrogen is especially important, and every amino acid in plants contains nitrogen as a necessary component for plants to manufacture new cells. As well as Sharma et al. (2003) reported that 0, 50, and 150 % of the recommended amounts of NPK fertilizers (125:33:50 kg/ha) with 0, 10, 20 t/ha cow manure combination increased onion yield and nutrient uptake. In an examination of the effect of N, P and K fertilizers on marigold, Zhiping et al. (2008) stated that K increased leaf yield and plant dry weight as well as plant growth and longevity. As well as Aslam and Ahmad (2002) studied the effect of various NPK doses on the growth and flowering of *Gladiolus* spp. and concluded that optimum rates of P and K and high rate of N resulted in higher vegetative growth indices including height, leaf number, leaf length and spike length. In a study on the impact of various substrates and fertilizing methods on growth and yield of common daisy. Mohammadi et al. (2014) found that soil application of fertilizer increased leaf number, plant height, flower diameter, flowering branch length, flower number, flower durability, shoot fresh weight and shoot dry weight as compared to its foliar application and no-fertilization. Bio-fertilizers appear to be a feasible option for continued agriculture on a commercial and profitable scale. Ashoorzadeh et al. (2016) found that vermicompost and NPK significantly improved the growth, yield and quality of rose flowers as compared to control and that the improvement was greater when vermicompost and NPK fertilizers were mixed. Gangadharan and Gopinath (2000) reported that application of 10 t of vermicompost ha^{-1} + 80 percent recommended NPK dose per ha for obtaining higher yield and net return per ha in *Gladiolus* spp. Also Amarjeet et al. (1996) recorded an increase of flower stalk height and leaf length in tuberose with an application of a higher dose of NPK and increased flowering period and the largest panicle length was produced with 200:200:400 kg/ha NPK. In addition, they are eco-friendly, easily available and cost effective.

This study was formulated to investigate the potential role of organic fertilizers application for enhancing growth, and flowering of *Hyacinthus orientalis* in a sustainable agricultural production system in order to reduce the amount of excessive chemical material released to the environment. However, information use of vermicompost along with different dosage NPK in the field of Siirt province is lacking. Therefore, the present experiment was designed with varying dosage of NP and vermicompost on *Hyacinthus orientalis* to find out the saving of chemical fertilizers with the use of vermicompost for maximum plant growth, flowering and nutrient content of hyacinth and to determine the effect of NP fertilizers and vermicompost on criteria of growth and flowering of *Hyacinthus orientalis* in different doses of NP fertilizers and vermicompost, and to determine the impact of vermicompost and NP fertilizer on plant growth and nutrient contents of hyacinth leaves and bulbs.

2. LITERATURE REVIEW

Hyacinth (*Hyacinthus orientalis*) is a spring-flowering bulb and is a well-known cut flower relates to family *Liliaceae*. It is a horticultural important plant and local of the West and Central Asia. Economically it is one of the most famous flowers worldwide. It has attracted the attention due to the variety of its color and pleasant perfume. It is usually propagated by separation of bulbs and grown for the breeding program through seeds (De Hertogh and Le Nard, 1993). Hyacinth flowering bulbs can be successfully grown in a wide area of soils. Loam and sandy loam soil with proper pH, aeration and drainage are necessary for the better harvest. The plant growing medium must be porous for root aeration and drainage and also able of water and nutrient holding. Oxygen, of course, is required for all living cells. The coarse-textured media often meet these elements. Manure, leaf shape, and other amendments may fulfill these requirements. Bulbs, corms, and tubers do well in media improved with organic manures (Arora, 2004).

Turkey is rich in the variety of plants, especially The East Anatolia Region is one of the rich areas in phases of geophytes (bulb, tuber, and rhizome bearing plants) of which more than 600 different species exist in Turkey (Davis, 1988; Koyuncu, 2002). Geophytes are important as ornamental plants with their excellent flowers in spring (Güner et al., 2000). Geophytes are used in the East Anatolia for several purposes and have an important economic value (Sezik, 1984). For successful cultivation of geophytes, pH should be around 7 contributed with phosphorus and potassium (Singh et al., 2002). Fertilization is one of the most significant cultural practices in recent plant production. Although of its major role in tree productivity and soil fertility in spite of all plants need certain mineral nutrients to remain.

These minerals occur naturally in the soil and are taken up from the soil by the roots of the plants. Most soils usually have complete of these minerals to keep plants healthy. However, some nutrients are constantly used up by the plants, or are washed out of the soil, and need to be replaced to support optimal growth and appearance. The most common mineral nutrients that need succeeding are nitrogen (N), phosphorus (P) and potassium (K). Fertilizers are made mixtures of chemical products that contain N, P, K and other necessary nutrients. They are increased over the soil to re-supply the soil with the conventional amount of these nutrients. The three numbers on the face of the fertilizer container represent the percentage by weight of N, P and K in that careful mixture. These numbers are used to calculate how much of a particular fertilizer to use at one time (Acosta and Tabatabai, 2000; Jemcev and Djukic, 2000).

As well as vermicompost part of organic fertilizer it is a simple biotechnological process of composting, in which some species of earthworms are used to improve the process of waste exchange and produce a better product. In vermicompost, compared to normal compost, accelerated bio-oxidation of organic matter is resolved mostly by high-density earthworm cultures (Dominguez et al., 1997). Vermicomposts are typically finely divided peat-like materials with high porosity, aeration, drainage, and water holding capacity. Nutrients in vermicompost are present in easily available forms for plant uptake; e.g. nitrates, exchangeable P, K, Ca and Mg. There is increasing importance in the potential use of vermicomposts as plant growth media and soil amendments (Edwards, and Burrows, 1988). Brewster and Butler (1989) and Randle (2000) also stated about the impact of nitrogen on development, flavor, and quality of onion bulb. Nitrogen also increases the vegetative growth, produces good quality foliage and promotes carbohydrate synthesis. A mixture of chicken manure and bio- fertilizer increases the yield of onion and improved nutrient content in tuber was reported by Shaheen et al. (2007).

Gülser et al. (2016) studied the effects of lead on nutrient contents of hyacinth (*Hyacinthus orientalis* L. c.v. "Blue Star") in lead-contaminated media. Four doses of lead as control, 20, 40 and 80 mg kg^{-1} were applied to each pot. The result showed that, the highest Mg, Fe and Cu contents of hyacinth bulbs were found as 0,59 %, 36,00 mg kg^{-1} and 3,40 mg kg^{-1} in control while the highest K (9,72 %), Zn (32,27 mg kg^{-1}) and Ca (2,69 %) were in 40 mg kg^{-1} and 80 mg kg^{-1} lead applications individually. On the other hand, the highest Mg (1,46 %) and Cu (13,75 mg kg^{-1}) contents of hyacinth leaves were found in control. The highest K (2,41 %), Ca (4,82 %), Fe (129,86 mg kg^{-1}) and Zn (50,14 mg kg^{-1}) contents of leaves were obtained in lead-contaminated media. Lead applications generally increased Fe and Zn contents and decreased of Cu content of hyacinth leaves.

Ali et al. (2014) studied the effects of humic acid (HA) and NPK to determine the optimum rate of different growth and flowering attributes on tulip cultivar viz. The data found in this study conveyed that HA (1,25 ml of 8 % humic acid) besides with NPK application (10 g/m^2 NPK) helps to improve the even crop stand, plant growth and flower quality of tulip. This study absorbed on the response of tulip flower for different humid acid concentrations. Beside with NPK to know the best treatment for maximum plant growth, nutrient uptake and vase life of the flower.

Mohapatra et al. (2005) studied the effects of N (10, 20 or 30 g/m^2), P (10 or 20 g/m^2) and K (10 or 20 g/m^2) fertilizers on corm production in gladioli (*Gladiolus grandiflorus* cv. Pink Prospector) in Bhubaneswar, Orissa. N at 20 and 30 g/m^2 resulted in the maximum number of compels per plant (10,73 and 10,14, respectively). The number of corm per plant did not significantly differ with the P rate. N, P and K rates, and the contact among the treatments had no important effects on the production of corms. The results revealed that N, P and K at 20 g/m^2 were best for corm production in gladioli.

Sultana et al. (2015) showed a pot experiment investigate the relative effect of cow manure, vermicompost and NPK fertilizers on the growth and flower production of zinnia (*Zinnia elegance*). An air-dried sandy loam soil was mixed with four rates of NPK fertilizer comparable to 0 (control), ½ dose (N:P:K 69:16:35 kg ha^{-1}), 1 dose (recommended) (N:P:K 137:32:70 kg ha^{-1}), 2 doses (N:P:K 274:64:140 kg·ha^{-1}) and 4 doses (N:P:K 548:128:280 kg ha^{-1}) and three rates of vermicompost comparable to 5 %, 10 %, 20 % by oven-dry weight. The response of *Zinnia* plant growth and flower production to vermicompost revealed much better results compared to NPK fertilizers. The NPK fertilizers were not active to improve flower production of *Zinnia* plants.

Branch (2013) determined the effects of various nitrogen treatments on growth and physiological characteristics of *Narcissus pseudonarcissus* were evaluated. Flowers were grown in sandy soil containing different levels of preservatives, counting, ammonium nitrate (0, 100, 200 kg ha^{-1}). The effects showed that using ammonium nitrate treatments significantly affected leaf longevity, bulb and bulb diameter, the concentration of carbohydrates and chlorophyll a, b and total chlorophyll contents. About of using ammonium nitrate, the best quantity was 200 kg ha^{-1}. In conclusion, the best treatment to improve growth and physiological characteristics of *Narcissus pseudonarcissus* was the careful 200 kg ha^{-1} ammonium nitrate.

Kejkar and Polara (2015) conducted a field experiment to regulate the effects of N, P and K on growth, bulb yield and nutrient content in Ratoon spider Lily (*Hymenocallis littoralis* L.). The treatments contained four levels of nitrogen (0, 200, 300 and 400 kg ha^{-1}), three levels of phosphorus (0, 100 and 200 kg ha^{-1}) and two levels of potassium (0 and 100 kg ha^{-1}). All the growth parameters were significantly influenced due to different levels of nitrogen. Application of nitrogen 400 kg N ha^{-1}

with three different split dosages recorded significantly the highest plant height, number of leaves per plant, leaf area, leaf length, diameter and weight of single bulb, number of bulbs per plant, bulb yield ha^{-1}, N content in leaves and bulbs. Phosphorus also played a significant role in improving growth parameters at higher level but, number of leaves per plant, bulb yield, P content in leaves and bulb. Potassium doses were significantly increased the P content in leaves and bulb. The optimum vegetative growth and bulb yield were obtained with combined application of 400 kg N ha^{-1} and 200 kg P_2O_5 ha^{-1}.

Jamil et al. (2016) determined the response of *Hippeastrum* c.v. "Apple Blossom" to different combinations of nitrogen, phosphorus and potassium levels. There were 14 treatment combinations including four levels of nitrogen viz. 0, 100, 200, and 300 kg ha^{-1}; five levels of phosphorus viz. 0, 200, 300, 400 and 500 kg ha^{-1} and five levels of potassium viz. 0, 100, 200, 300 and 400 kg ha^{-1} with cow dung treatment at the rate of 10 kg ha^{-1}. The growth and the flowering parameter of *Hippeastrum* were significantly influenced by combined request of NPK. The highest standards in respect of leaves per plant (8,6), leaf width (5,4 cm) ,number of plants per bulb (3,07), flower scape per plant (2,07), flowers per scape (4,2), length and diameter of flower (14 cm x 13,83 cm), flower scape (43,33 cm x 29,37 cm) and flowering duration (10,7 days) were practical with NPK 200:400:300. The same treatment revealed earliness in days to flower scape emergence (172,3 days), days to flower bud appearance (185,3 days) and days to first flower open (189,3 days). The biggest flower (14,00 cm x 13,83 cm), longest flower scape (43,33 cm), the maximum number of flowers per scape (4,20), and maximum flowering duration (11,5 days) were also shown by the treatment NPK 200:400:300. The control treatment recorded the lowest values except for days to first leaf emergence, days to flower scape emergence, days to flower bud arrival and days to first flower open.

Dalve et al. (2009) described that the growth parameters like plant height and number of leaves, flowering parameters like days required for emergence of spikes, days required for first pair of florets, days required for 50 % flowering, yield paying characters like number of florets/spike, number of spike/plant, corms and cormels per plant and per hectare in *Gladiolus* were completely influenced by the submission of both the biofertilizers in combination with nitrogen and it was maximum under 75 % N + 100 % NPK+ *Azotobacter* + *Azospirillum* and at par with the treatment 100 % NPK + *Azotobacter* + *Azospirillum*. Thus there was 25 % saving of nitrogenous a fertilizer which was changed by the biofertilizers.

Dongardive et al. (2009) studied the effect of organic manure and biofertilizers on yield and yield contributing parameters of corms and cormels in *Gladiolus* cv. White Prosperity. The data showed that the yield in terms of a number of corms and weight of corms and cormels per plant, the weight of corm and cormels per hectare and diameter of corms were found to be greatly influenced by the treatment where recommended dose of fertilizer Resoure Description Framework (RDF) (500:200:200 NPK kg/ha) applied. The treatment RDF (500:200:200 NPK kg/ha) created highest corm yield of 33,70 kg/ha with 16,23 g plant^{-1} yield of cormels. The treatment of vermicompost 8 t/ha + (*Azotobacter* 5 kg/ha) + Phosphate Solubilizing Biofertilizer (PSB) 5 kg/ha also revealed significant results were creating corm yield of 32,80 kg/ha and cormels yield weighing 15,36 g plant^{-1}. Thus significantly the maximum corm and cormels yield was found in the treatment where RDF (500:200:200 NPK kg/ha) was applied and in the treatment of vermicompost 8 t/ha respectively as related to other treatments.

Ali et al. (2013) calculated the effect of different bio-fertilizer on growth and flower quality characteristics of gladioli (*Gladiolus grandiflorus* L.). The current results have shown that all the vegetative and generative growth accomplished positively by application of biofertilizers. However, the treatment contains Azospirillum gained highest values in terms of plant height, florets spike^{-1}, spike length, florets fresh weight and earlier sprouting than rest of the treatments. The character of biofertilizers in cormels production and nutrient uptake, the treatment had also superiority with more cormels plant^{-1} and played important role in nutrient (NPK) absorption than the control one. So, in this experiment biofertilizer has been recognized as another to chemical fertilizer in order to increase soil fertility and crop production in sustainable farming.

Singh et al. (2002) resoluted the effects of N (0, 25, 50 and 75 g/m^2), P (0, 20 and 30 g/m^2) and K (0 and 20 g/m^2) on the N, P and K content of the leaves of *Gladiolus grandiflorus* cv. Sylvia in a field experiment. N, P and K content in the leaves of *Gladiolus* increased with increasing rates of N, P and K fertilizers. P application increased the N rank in the leaves of the plant. N and K application caused the increase in leaf P content although the increase was not significant. Leaf K content increased significantly with the application of N and K fertilizers. The effects of P on K content of the leaves were not important.

Nagaich et al. (2003) showed a field experiment to determine the effects of N (0, 40, 80 or 120 kg/ha) and P (0, 20, 40 or 60 kg/ha) on the growth, yield and quality of marigold (*Tagetes erecta*). Flower yield; N, P and K uptake; net income; and benefit:

cost ratio improved with increasing rates of N and was highest with the application of 60 kg P/ha except for N uptake which was highest with the application of 20 kg P/ha. Significant communication effects between N and P were recorded.

Zhiping et al. (2008) stated that K increased leaf yield and plant dry weight as well as plant growth and longevity. In a calculation of the effect of different planting media including rice husk, coco peat, perlite, and a mixture of perlite and vermiculite (1:1) and NPK rates including two NPK concentrations (25:7:7) of 1,75 and 2,5 g l^{-1} on *Chrysanthemum*, the best quality of cut flowers were found from rice husk substrate sprayed with 2,5 g l^{-1} NPK.

Sabah et al. (2014) studied the effect of different organic and inorganic manure on growth and flowering of *Dahlia* (*Dahlia variabilis*) cv. Glory of India as intercropping with Damask Rose was shown the glory of India was planted in four different planting media control, Farm yard manure (FYM), FYM + NPK, poultry manure, poultry manure + NPK and vermicompost, vermicompost + NPK in different combinations. Maximum weight of the flower (92,67 g) were created with poultry manure 30 t ha^{-1} + NPK. Whereas, minimum flower weight (51,33 g) was created with FYM 10 t ha^{-1} vermicompost 10 t ha^{-1}. Maximum weight of the tubers (996,67) was produced by poultry manure 30 t ha^{-1} + NPK. Whereas, the minimum weight of the tubers (225,48) was produced with FYM 10 t ha^{-1}.

Selvaraj (2004) showed an experiment under poly house conditions in Ooty, Tamil Nadu, India to evaluate the effect of different NPK levels (50:50:50, 50:50:100, 50:100:50: 50:100:100, 100:50:50, 100:50:100, 100:100:50 and 100:100:100 kg/ha) on the vegetative and flowering characteristics of *Gladiolus* cv. Eurovision. NPK at 100:100:100 kg/ha recorded the maximum values for plant height (106,3 cm), number of florets per spike (13) and spike length (58,4 cm). The untreated control recorded the lowest standards for these parameters.

Chamani et al. (2008) studied the effects of vermicompost of an animal manure origin on the growth and flowering of *Petunia hybrida* ‘Dream Neon Rose’ grown under glasshouse conditions were determined. *Petunia* seeds were propagated, transplanted into media and grown for 150 days. The traditional base medium (control) was a mixture of 70 % farm soil and 30 % sand (v/v). Treatments were either vermicompost incorporated at 20, 40 and 60 % or sphagnum peat incorporated at 30 and 60 % into the base medium. Treatments were either vermicompost incorporated at 20, 40 and 60 % or sphagnum peat combined at 30 and 60 % into the base medium. In this study showed that vermicompost had important positive effects on flower numbers, leaf growth and shoot fresh and dry weights associated with both control and peat amended media. Plant performance was best in the 20 % vermicompost medium. Further increasing the vermicompost content in the base media decreased flower numbers, leaf growth rates and shoot fresh and dry weights. Plant performance was lowliest in the 60 % sphagnum peat medium.

Sultana et al. (2015) studied the effect of integrated organic and inorganic nitrogen on growth and nutrient concentration in summer onion (*Allium cepa*), in this study were used twelve treatments in the research and in each treatment, different combinations of urea, cow dung, and vermicompost were used to quantity nitrogen (N) at the rate of 120 kg/ha. The treatments included- control or no fertilizer provided (T1), 120 kg N/ha supplied from urea (T2), 100 kg N/ha supplied from urea with 20 kg from cow dung (T3), 100 kg N/ha supplied from urea with 20 kg from vermicompost (T4), 80 kg N/ha provided from urea with 40 kg from cow dung (T5), 80 kg N/ha provided from urea with 40 kg from vermicompost (T6), 60 kg N/ha provided from urea with 60 kg from cow dung (T7), 60 kg N/ha supplied from urea with 60 kg from vermicompost (T8), 40 kg N/ha provided from urea with 80 kg from cow dung (T9), 40 kg N/ha supplied from urea with 80 kg from vermicompost (T10), 120 kg N/ha provided from cow dung (T11), 120 kg N/ha provided from vermicompost (T12). Data on plant height, number of leaves, leaf length, bulb length, and bulb weight of onion were recorded. Samples of bulb and leaf were analyzed for determining the total nitrogen, phosphorous, potassium, and sulfur content. The height of plant ranged from 24,25 to 39,25 cm with lowest and highest value from T1 and T5, individually. Like plant height, the longest leaf length and bulb length were observed in T5, whereas the shortest leaf and bulb length were recorded in T1 treatment. Statistically insignificant differences were recorded on a number of leaves/plant. The highest nitrogen, phosphorous, potassium and sulphur content in bulb (2,30, 0,185, 1,71 and 0,96 %, respectively) and in leaf (2,91, 0,183, 2,45, and 0,98 %, respectively) were recorded in treatment T5. Whereas, the lowest nitrogen, phosphorous, potassium, and sulfur content in the bulb (1,41, 0,055, 0,89, and 0,66 %, respectively) and in leaf (2,15, 0,053, 1,71 and 0,63 %, respectively) was found in T1. Therefore, the general results suggest that treatment T5 which provided 40 kg N/ha from cow dung and rest 80 kg from inorganic urea resulted in maximum plant growth and nutrient absorption and can be suggested for best production of summer onion.

Kashem et al. (2015) studied the effect of cow manure, vermicompost and inorganic fertilizers on the vegetative growth and fruits of tomato plant (*Solanum lycopersicum* L.). An air-dried sandy loam soil was mixed with five rates of vermicompost equivalent to 0 (control), 5, 10, 15 and 20 t ha^{-1} and three rates of NPK fertilizer comparable to 50 % (N:P:K = 69:16:35 kg ha^{-1}), 100 % (N:P:K = 137:32:70 kg ha^{-1}) and 200 % (N:P:K = 274:64:140 kg ha^{-1}). The result showed that shoot length, number of leaves, dry matter weight of shoots and roots, fruit number and fruit weight were influenced significantly by the application of vermicompost and NPK fertilizer in the growth radio. The maximum dose of vermicompost of 20 t ha^{-1} increased dry weight of shoot of 52 folds and root of 115 folds, number of fruit(s)/plant of 6 folds and mean fruit weight of 29 folds while the highest rate of NPK fertilizer of 200 % increased dry weight of shoot of 35 folds and root of 80 folds, number of fruit(s)/plant of 4 folds and mean fruit weight of 18 folds over the control treatment. The growth show of tomato was better in the vermicompost amended soil pots than the plants grown in the inorganic fertilizer corrected soil pots. This study suggested that the vermicompost served as a possible source of nutrients for plant growth.

Ali et al. (2014) studied the effects of humic acid (HA) and NPK to determine the optimum rate of different growth and floral attributes on tulip cultivar viz. The following five treatments T0: (control), T1: 10 g/m^2 NPK (17:17:17), T2: HA 0.75 ml (8 %) + 10 g/m^2 NPK (17:17:17), T3: HA 1,00 ml (8 %) + 10 g/m^2 NPK (17:17:17) and T4: HA 1,25 ml (8 %) + 10 g/m^2 NPK (17:17:17) were used. The result showed that all the vegetative and reproductive characteristics were significantly influenced by the extension of humid acid and NPK and obtained results showed that treatment T4 was the most effective one compared with the other treatments. This treatment gave the perfect outcomes concerning spring sprouting and flowering, plant height supplement, leaf area extension, stem diameter, leaf chlorophyll contents, stalk length, vase life, fresh and dry flower biomass. It also increased the nutrient contents comparing with the T3 and T2. In comparison, the plants are grown without HA and NPK application (control) followed by a single application of NPK (T1) showed poor growth with reduced yield of lower quality. The data obtained in this study carried that HA (1,25 ml of 8 % humic acid) along with NPK application (10 g/m^2 NPK) helps to improve the normal crop stand, plant growth and flower quality of tulip.

Güneş et al. (2009) studied the effect of different rate of fertilizers (0, 3, 6, 9, 12 g/pot composite fertilizer N 12 %: P 12 %: K 12 %: humic acid 20 %) on some

agronomical and floristic characters (length, leaf number, leaf dry matter percentage, dry weight of leaves, flower-bud number, root dry matter percentage, dry weight of roots) of rose plants were tried by pot experiments in greenhouse. Explanations and measurements were conducted during the dated of May 2006-May 2007 and the most favorable results were obtained by 6 g/pot of fertilizer treatment. However, 3 g/pot of fertilizer treatment had also a positive effect on all characters except dry matter content and dry weight of roots. It was also concluded that this type of studies on plant nutrients should be conducted distinctly.

3. MATERIAL AND METHODS

3.1. Experimental Site

The present experiment was carried out during 2016-2017 at the Siirt University. The research farm is situated at the 2614 "North latitude and 7814" East longitudes and at an altitude of 206 meters above sea level.

3.2. Climate and Weather Condition

Siirt enjoys a semi-arid and subtropical climate with hot and dry summers, where maximum temperatures exceed 45 ºC, the winters are cold and the minimum temperatures can reach as low as 5 ºC in December and January.

Some climate data from the vegetation period between November 2016 and May 2017 parameters were presented in Table 3.1 and Table 3.2.

Table 3.1. Some climatic values of the year where the experiment was made (Anonim, 2017)

Parameter	November 2016	December 2016	January 2017	February 2017	March 2017	April 2017	May 2017	Average
Monthly avarege temperature (°C)	10,4	3,3	3,0	2,6	9,7	14,2	19,5	8,9
Monthly average of daily max. temperatures (°C)	16,45	7,2	7,4	7,9	14,8	20,0	25,1	14,1
Monthly average of daily min. temperatures (°C)	6	0,6	-0,2	-1,5	5,3	9,3	13,9	3,0
Average monthly 50 cm of soil temperature (°C)	15,6	8,6	6,6	5,9	10,1	14,5	19,4	11,5
Average monthly relative humidity (%)	49,7	73,1	65,9	64,9	63,5	59,3	51,7	61,1
Average monthly total precipitation (mm)	55,6	121,4	49,4	45,6	118,8	149,9	74,8	87,9

Table 3.2. The temperature average of Siirt province for many years (Anonim, 2017)

Parameter	Jan.	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct.	Nov	Dec	Yearly
Monthly avarege temperature (°C)	2,6	4,2	8,2	13,.8	19,3	25,9	30,6	30,3	25,4	18,2	10,4	4,7	16,1
Average monthly total precipitation (mm)	96,3	98,4	111,0	104,4	62,6	9,5	2,8	1,7	7,1	50,3	82,5	95,3	721,9

3.3. Soil Characteristics

A perusal of the (Table 3.3) shows that the percentage of sand was more in comparison to other fractions. Thus, the soil is categorized as sandy loam with low aggregation. The chemical composition of the soil collected from 0-30 cm depth before planting of *Hyacinthus* bulbs.

Table 3.3. Some soil characteristics of the experiment field

Analysis	Unit	Method	Results	Evaluation
Texture type	%	Water saturation	72	Clay
pH	-	Water saturation	7,33	Notr
Ec	ds/m	Water saturation	1,12	Saltless
Lime	%	Scheibler	14,8	Medium lime
Organic matter	%	Walkley-Black	1,64	Little
Phosphorus (P_2O_5)	kg/da	Olsen	3,70	Little
Potassium (K_2O)	kg/da	Amonium asetate	128,7	Enough

3.4. Experimental Details

The present study has been carried out on *Hyacinthus orientalis* L. "Purple Star" cultivar. It was conducted in the research and practice field of Siirt University Faculty of Agriculture, during the 2016-2017 vegetation period. The experiment was laid out in a randomized block design with 7 treatments and three replications. The experimental field has selected the area and it was prepared to dig by tractor. The layout was applied to division replications, rows, and plant locations.

The plants were planted on the November 2016, with vermicompost and 20:20:0 N:P:K fertilizer. Vermicompost dosages were used as 25, 50 and 75 g/plant on each bulb hole. 2, 4, and 8 kg da^{-1} dosages were calculated from N ve P_2O_5 containing inorganic fertilizer for treatments were applied as (Table 3.4).

Table 3.4. Treatments of vermicompost and NP fertilizer dosages

Vermicompost and NP fertilizer dosages	Treatment
Control (no fertilizer)	Control
20:20:0, 2 kg da^{-1} for plot	NP1
20:20:0, 4 kg da^{-1} for plot	NP2
20:20:0, 8 kg da^{-1} for plot	NP3
25 g vermicompost for bulbs	V1
50 g vermicompost for bulbs	V2
75 g vermicompost for bulbs	V3

The fertilizations were applied at the time of planting to each bulb. End of the experiment, the following parameters and observations were taken.

3.5. Following Parameters and Observations

3.5.1. First flowering time (day)

The period taken for the opening of the floret was recorded from the date of spike initiation to the first florets opening were presented in (Figure 3.1).

Figure 3.1. First flower opening

3.5.2. Full flowering time (day)

A number of days required for the full flowering time or the floret opening from the plantation moment to 50 percent sprouting of flowers, were presented in Figure 3.2.

Figure 3.2. Full flowering opening

3.5.3. Harvest time (day)

Days needed for the last (1-2) florets closing on the top of flower from the date of the spike after (1-2) the closing of the florets Figure 3.3.

Figure 3.3. Harvest time

3.5.4. Leaf number/plant

A number of leaves per plant were counted on harvest time.

3.5.5. Leaf height (mm)

Leaves height it was measured were presented in Figure 3.4.

Figure 3.4. Leaf height

Figuer 3.5. Leaf diameter

3.5.6. Leaf diameter (mm)

Leaves diameter was measured were presented in Figure 3.5.

3.5.7. Plant height (mm)

Plant height was measured in the earth from the top of the plant, were presented in Figure 3.6.

Figure 3.6. Plant height

3.5.8. Flower height (mm)

The height of the flower was measured from the last flower from the top, were presented in Figure 3.7.

Figure 3.7. Flower height

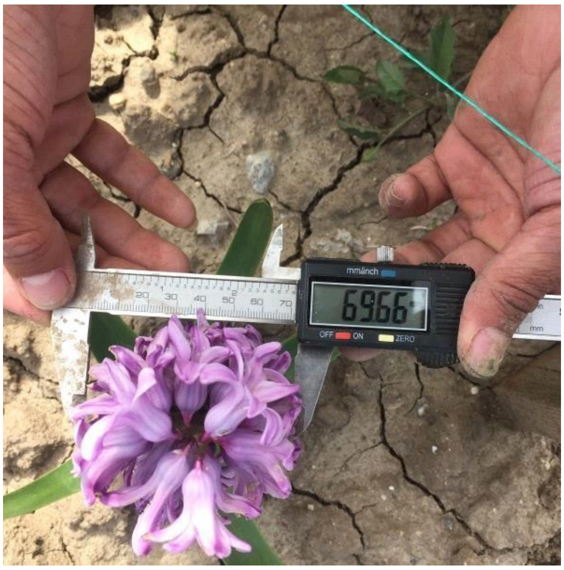

Figure 3.8. Flower diameter

3.5.9. Flower diameter (mm)

The width of the flower was measured in mm for each flower in each treatment, were presented in Figure 3.8.

3.5.10. Floret height (mm)

The height of the floret was measured on the completion of the flowering time, were presented in Figure 3.9.

Figure 3.9. Floret height

Figure 3.10. Floret diameter

Figure 3.11. Stalk thickness

3.5.11. Floret diameter (mm)

The diameter of floret was measured on harvest or full flowering time, was presented in Figure 3.10.

3.5.12. Floret number

A number of floret per one flower was counted on full flowering time.

3.5.13. Stalk thickness (mm)

The stalk thickness was measured in mm on full flowering time, was presented in Figure 3.11.

3.6. Analysis of Plant Nutrient Elements in Leaves and Bulbs

During the flowering, nutrient element analysis were done on the leaves to be taken. Leaf and bulb samples were taken from plants selected from the centers of the plots due to edge effect leaves are first washed in tap water, then rinsed with distilled water and left to stand in laboratory conditions. After drying in a drying cabinet at 70 ºC temperature, it grinded by milling and stored in dry and cool place for analysis (Figure 3.12 and Figure 3.13). The levels of nutrients of samples were analyzed according to the methods reported by Kacar and Inal (2008). Nitrogen level was analyzed by Kjeldahl method, other element levels by microwave method with Thermo Scientific marka ICAP Q model ICP-MS.

Figure 3.12. Preparation of leaf samples for analysis

Figure 3.13. Preparation of bulb samples for analysis

3.7. Statistical Calculations

Data were analyzed by the analysis of variance method for two-factor randomized block design, SAS 9.1 Statistical Package Program was used for the analysis. The LSD multiple comparison test was used to compare the averages. Tests were conducted at α= 0,05 significance level (Düzgüneş et al., 1987). Descriptive statistics, like mean and standard errors were represented for the investigated feaatures.

4. RESULTS AND DISCUSSION

The results of the present investigation related to the impact of NP fertilizers and vermicompost levels treatments, mainly on growth, floral characters, nutrient content, explained in this chapter. The data of the final observations of the various parameters during growth and flowering phase were subjected to statistical analysis and the results have, therefore, be presented through tables and suitable diagrams. The effects of vermicompost and NP applications were found not significant statistically (Table 4.1).

Table 4.1. Effects of NP and vermicompost dosages on parameter of hyacinth

Treatment	first flowering time (day)	full flowering time (day)	harvest time (day)	leaf number (mm)	leaf height (mm)	leaf diameter (mm)	plant height (mm)	flower height (mm)	flower diameter (mm)	floret height (mm)	floret diameter (mm)	floret number	stalk thickness (mm)
Control	136,35	138,38	140,92	5,543	118,88	26,307	165,28	103,16	63,92	24,080	26,797	35,910	12,347
V1	135,25	136,54	137,70	5,710	128,28	27,637	174,38	115,83	64,63	25,337	28,140	32,147	13,507
V2	136,17	137,59	139,35	5,620	121,34	27,177	177,99	112,57	66,96	25,100	26,490	35,913	12,617
V3	135,67	137,11	138,67	5,413	126,03	26,523	178,36	116,33	60,72	26,253	25,693	33,807	12,793
NP1	135,90	137,38	139,55	5,380	127,52	28,311	175,02	115,17	64,48	25,213	26,480	37,690	13,350
NP2	135,340	136,618	138,331	5,545	127,188	26,46	176,095	114,244	66,942	26,768	26,908	36,641	12,896
NP3	136,158	137,736	138,550	5,667	123,277	28,86	179,547	111,394	61,806	25,423	26,176	34,370	12,621

4.1. Plant Growth Criterias

4.1.1. First flowering time

The data regarding days to first flowering time are presented in Table 4. It is non-significant difference was observed in case of first flower open of hyacinth the first flower open was the earliest (135,25) in V2 which was closely followed by NP2 and NP3 and V3. The control plants took the maximum days (136,35) which was followed by other treatment for the first flower open. It is clear from the results (Figure 4.1) that the increasing level of NP2 increasing the time required for the first flowering time of hyacinth but increasing level of NP3 decreased the time required for the first flowering time and that the increasing level of V2 increasing the time required for the first flowering time of hyacinth but increasing level of V3 decreased the time required for the first flowering time. But it was not significantly different because they didn’t have a good compare with control, as showing in Table 4.1. Sönmez et al. (2013) showed that the lowest number of days to primarily flower formation (116 days), the lowest number of days to mature flower formation (117 days), the lowest number of days to harvest (121 days), the lowest number of days to primarily floret formation (123 days), on plant gladioli.

Sharma et al. (2003) observed that on various growth. Flowering and bulb production attributes of tuberose were recorded that among the different N doses minimum time is taken for sprouting (14,74 days) was recorded with the application of 300 kg N/ha whereas maximum time (21,57 days) for sprouting of bulbs was recorded in control. Early sprouting in tuberose with higher doses of nitrogen, phosphorus, and their interaction might be due to the stimulation of bulbs by comparatively high nutrient availability (N and P) and their respective absorption through bulbs surface and primary roots. Keisam et al. (2014) observed that first flowering time of *Gladiolus* was greatly influenced by different combinations of organic and inorganic fertilizers, Vermicompost 2.5 t ha^{-1} + humid acid 0,2 % + Vesiculer Arbuscuar Mycorrhiza. Leaf width (8,626 cm) was recorded the minimum number of days taken for first floret to open (51,35 days).

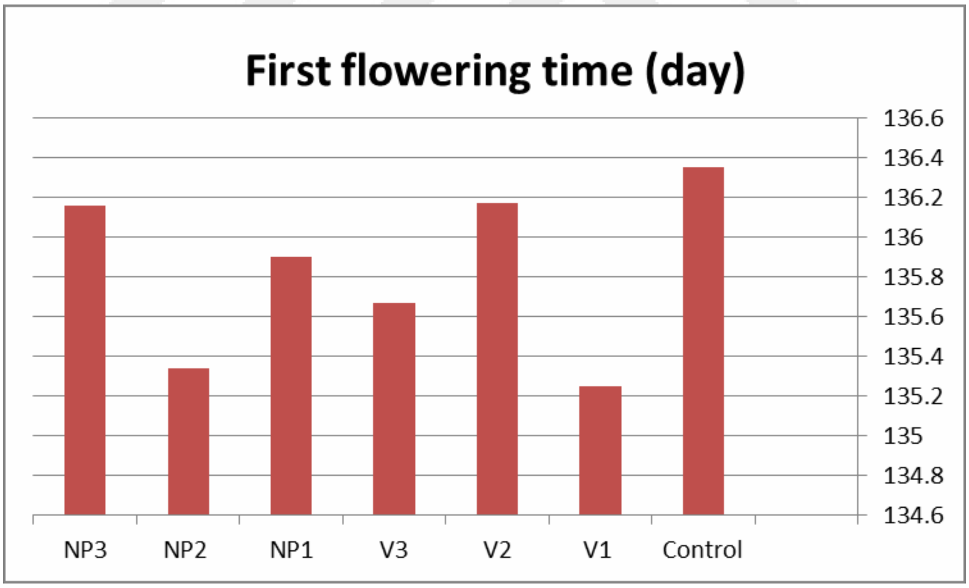

Figure 4.1. First flowering time (day) under fertilizer treatments

4.1.2. Full flowering time (day)

The data pertaining to days taken to full flowering time, as influenced by different treatments have been presented in Table 4.1. Statistically non-significant difference was observed in case of full flowering time (days) of hyacinth by different levels of NP fertilizers and vermicompost. However, it can be revealed that days to the full flowering time was the earliest (136,54 days) in V1 which was closely followed NP2 and other treatment. The control plant took the longest time (138,138 days), for the full flowering time. It is clear from the results Figure 4.2 that the increasing level of NP2 increasing the time required for the full flowering time of hyacinth but increasing level of NP3 decreased the time required for the full flowering time and that the increasing level of V2 increasing the time required for the full flowering time of hyacinth but increasing level of V3 decreased the time required for the full flowering time. But it was not significantly different because they didn't have a good compare with control as showing in (Table 4.1). However Rajadurai and Beaulah (2000) also found that increasing levels of NP fertilizers resulted in the full flowering of African marigold, which also brought about full flowering, contains essential plant nutrients like N, P, K, Ca, Fe, S, Mg, Zn, Mo, Cu, Mn, Cobalt and Boron in a balanced amount in addition to bio fertilizers, which gave rise to full flowering. Similar results were also reported by Chkkaborty et al., 2009. Farmyard manure brought about the late flowering of marigold in 78,3 days i.e. late by 9,48 days over vermicompost. The flowering duration was also maximum (up to 24,51 days) due to the application of vermicompost. This is may be due to differences in their source and nutrient composition as well as the timing of nutrient availability to the flowering plants. Sönmez et al. (2013) showed that the lowest number of days to primarily flower formation (116 days), the lowest number of days to mature flower formation (117 days), the lowest number of days to harvest (121 days), the lowest number of days to primarily floret formation (123 days), the lowest number of days to fade of floret (121 days) on plant gladioli.

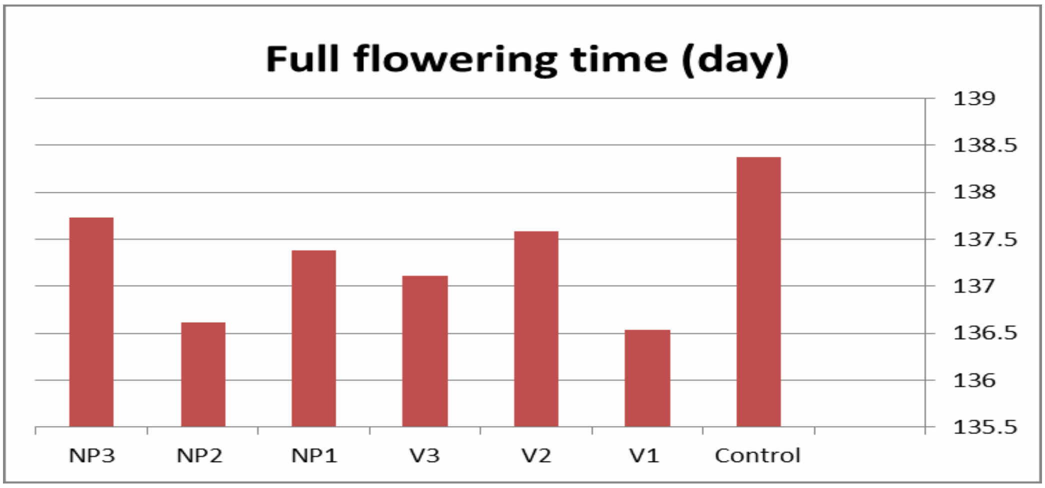

Figure 4.2. Full flowering time (day) under fertilizer treatments

4.1.3. Harvest time (day)

The data pertaining to days taken to harvest time, as influenced by different treatments have been presented in Table 4.1 and Figure 4.3. Non-significant difference was observed in case of harvest time (day) of hyacinth by different levels of NP fertilizers and vermicompost. However, it can be revealed that days to the harvest time was the earliest (137,70 days) in V1 which was closely followed NP2 and other treatment. The control plant took the longest time (140,92 days), for the harvest time. It is clear from the results Figure 4.3 that the increasing level of NP2 decreased the time required for the harvest time of hyacinth but increasing level of NP3 increasing the time required for the harvest time and that the increasing level of V2 the time required for the harvest time of hyacinth but increasing level of V3 decreased the time required for the harvest time as showing in Table 4.1.

Similar results were also reported by Chakkaborty et al. (2009). On the other hand, farmyard manure brought about the late flowering of marigold in 78,3 days i.e. late by 9,48 days over vermicompost. The flowering duration was also maximum (up to 24,51 days) due to application of vermicompost. This is may be due to differences in their source and nutrients composition as well as timing of nutrients availability to the flowering plants. Sönmez et al. (2013) showed that the lowest number of days to primarily flower formation (116 days), the lowest number of days to mature flower formation (117 days), the lowest number of days to harvest (121 days), the lowest number of days to primarily floret formation (123 days), the lowest number of days to fade of floret (121 days) on plant gladioli.

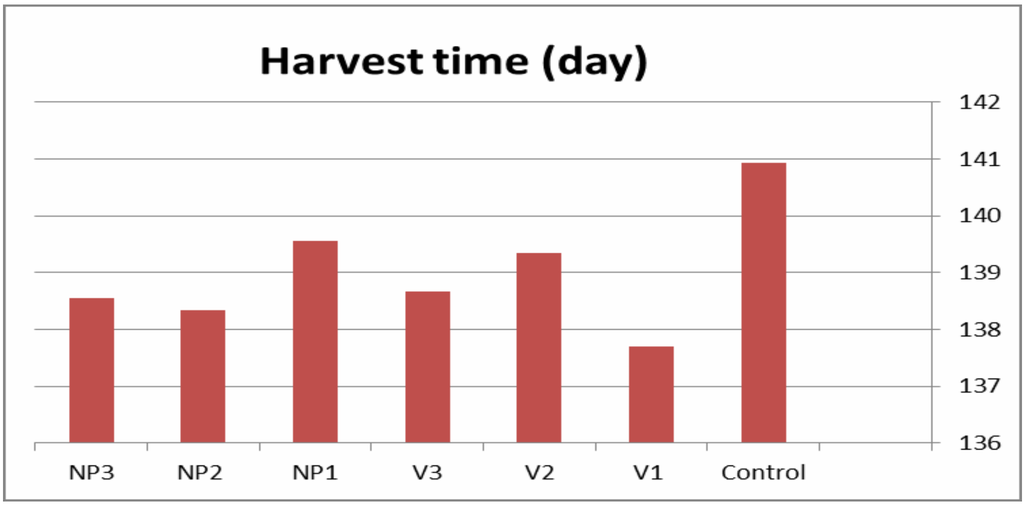

Figure 4.3. Harvest time (day) under fertilizer treatments

4.1.4. Leaf number

Leaf number was counted and no significant variation was found due to different levels of NP and vermicompost presented in Table 4.1. Leaf number varied from 5,413 to 5,710 per plant. The maximum number of leaves (5,710) was recorded with the V1 was statistically similar by other treatment. It is presented from the results (Figure 4.4) that the increasing level of NP increasing the leaves number of hyacinth. And that is the increasing level of vermicompost decreased the leaves number of hyacinth. It was not significant result because a maximum number of leave was recorded by V1 and followed by other treatment. This result is in agreement with the findings of El-Desuki et al. (2006). They observed that N application had no significant effect on a number of leaves of onion. Also Sultana et al. (2015) observed that number of leaves/plant of summer onion was found insignificant when the influence of integrated N from urea, cow dung, and vermicompost was compared. The highest number of leaves/plant (6,00) was observed in treatment 120 kg N/ha supplied from urea followed by other treatments.

Alternatively, the minimum number of leaves (4,98) per plant was found in control plots, where no fertilizer was applied. Also Keisam and Kumar (2014) observed that leaf number of *Gladiolus* was greatly influenced by different combinations of organic and inorganic fertilizers. Number of leaves (5,60) were obtained from Vermicompost 2.5 t ha^{-1} + humic acid 0,2 % + Vesiculer Arbuscuar Mycorrhiza.

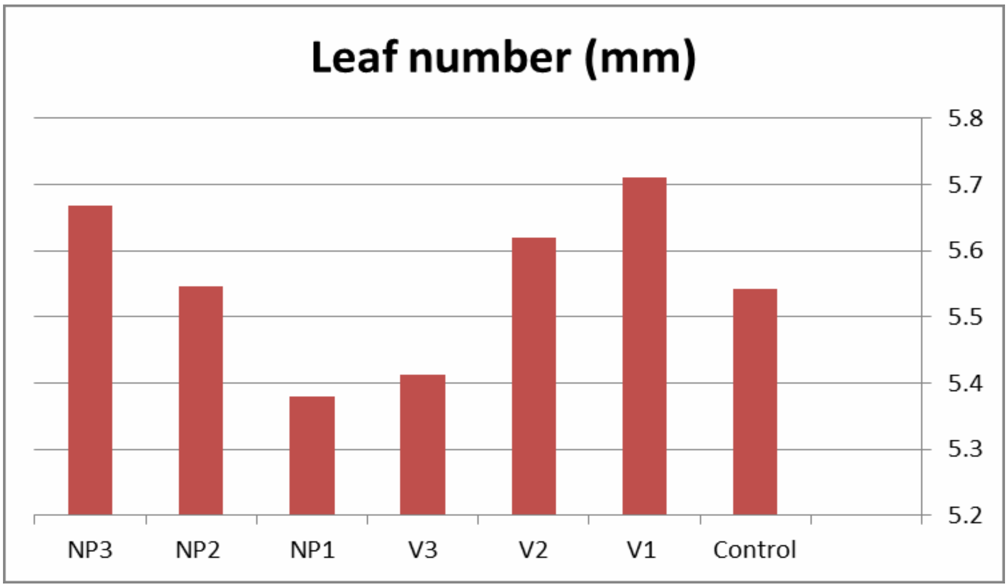

Figure 4.4. Leaf number under fertilizer treatments

4.1.5. Leaf height (mm)

Leaf height of hyacinth varied from 118,88 mm to 128,28 mm over the treatments (Table 4.1). The leaf height (128,28) was recorded with V1 which was closely followed by NP1 and NP2 and V3. The minimum leaf height (118,88 mm) was produced from the control which was followed by and statistically similar with V2 and NP3. It is presented from the results (Figure 4.5) that the increasing level of NP decreased the leaf height of hyacinth, the increasing level of vermicompost decreasing the leaf height of hyacinth. However, the best performance was recorded in the leaf height with V1, on other hand Sönmez et al. (2013) observed that the highest leaf length (47,9 cm), the highest plant length (70,6 cm), while the highest leaf diameter (30,78 mm) was obtained in waste mashroom compost application, on plant gladioli.

Sultana et al. (2015) observed that the results showed that the rate effects within NPK fertilizers and vermicompost treatments were not found significant on leaf length of (*Zinnia elegans*) flowers. However, Keisam et al. (2014) observed that leaf length of *Gladiolus* was greatly influenced by different combinations of organic and inorganic fertilizers. The leaf length (50,03 cm) was obtained from Vermicompost 2,5 t ha^{-1} + humid acid 0,2 % + Vesiculer Arbuscuar Mycorrhiza.

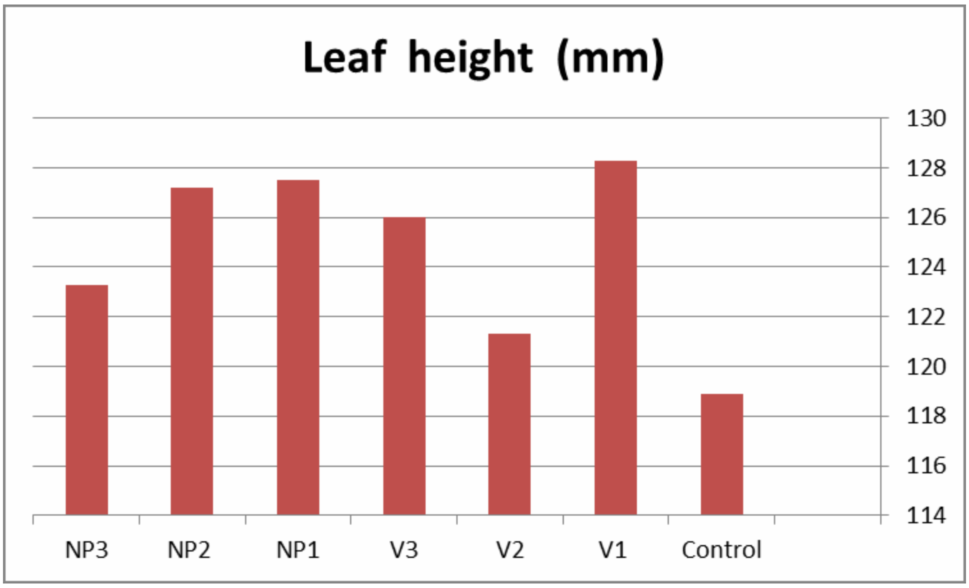

Figure 4.5. Leaf height (mm) under fertilizer treatments

4.1.6. Leaf diameter (mm)

Leaf diameter of hyacinth varied from 26,307 mm to 28,86 mm over the treatments (Table 4.1). The widest leaf (28,86 mm) was recorded with NP3 which was followed by and statistically similar with NP1 and V1 and V2. The narrowest leaf (26,307 mm) was produced from the control closely flowed by other treatments. Non- significant different it is showed from the results (Figure 4.6) that the increasing level of NP2 decreased the leaf diameter but increasing level of NP3 increasing leaf diameter of hyacinth. And that the increasing level of vermicompost are decreased the leaf diameter of hyacinth. It was not significantly different. Sönmez et al. (2013) observed that the highest leaf length (47,9 cm), the highest plant length (70,6 cm). While the highest leaf diameter (30,78 mm) was obtained in waste mashroom compost application, on plant gladioli. Keisam et al. (2014) observed that leaf width of *Gladiolus* was greatly influenced by different combinations of organic and inorganic fertilizers. The leaf width (8,626 cm) was determined on vermicompost 2,5 t ha^{-1} + humid acid 0,2 % + Vesiculer Arbuscuar Mycorrhiza treatment.

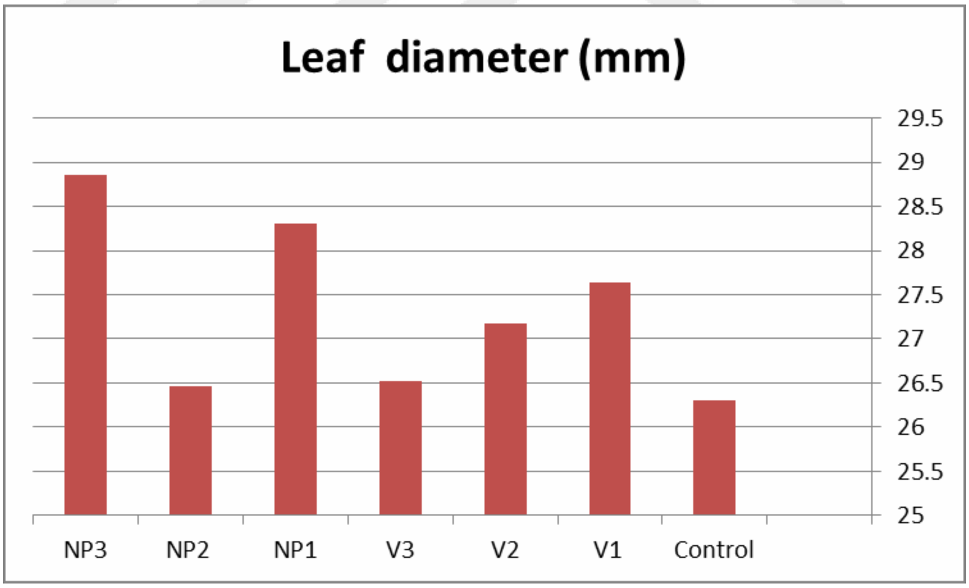

Figure 4.6. Leaf diameter (mm) under fertilizer treatments

4.1.7. Plant height (mm)

Plant height of hyacinth was measured on flowering. It was observed that plant height was influenced not significantly by different levels of NP and vermicompost application (Table 4.1). The tallest plant (179,547 mm) was recorded in NP3, which was followed by and statistically similar with other treatment. And the shortest plant (165,28 mm) was found in control. Non-significant different it is presented from the results (Figure 4.7) that the increasing level of NP are increasing the plant height of *H. orientalis* and that the increasing level of vermicompost are increasing the plant height of hyacinth but it was non-significant different. Sönmez et al. (2013) observed that the highest plant length (70,6 cm), was obtained in waste mashroom compost application, on plant gladioli. El-Desuki et al. (2006) stated that plant height of onion increased with increasing rates of N up to 125 kg/ha and decreased thereafter. Also, Sultana et al. (2015) observed that the impact of NP fertilizers on the shoot heights of *Zinnia* plant was found similar with that of control. Shoot heights of plant increased with the rates of vermicompost application but the values obtained in the 10 % and 20 % was not significantly different.

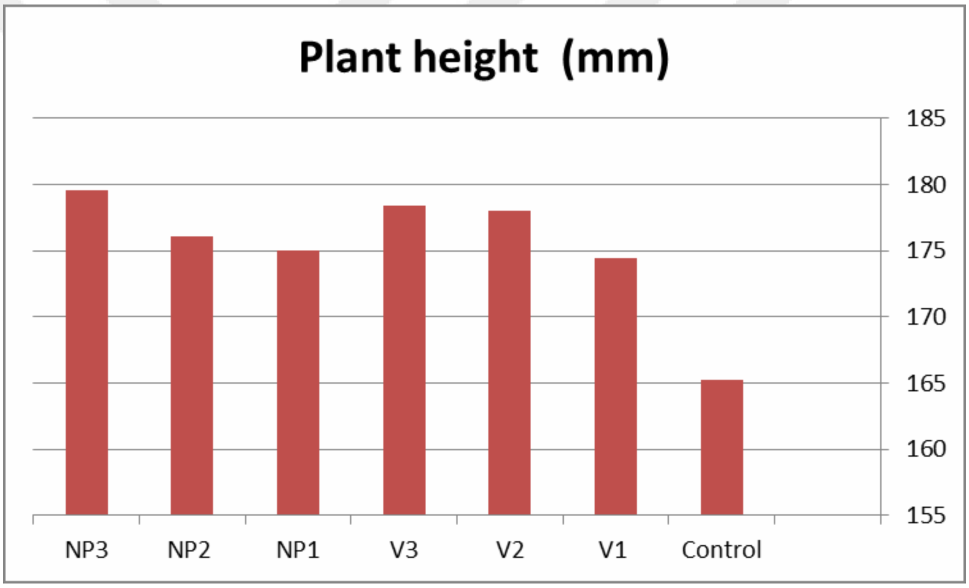

Figure 4.7. Plant height (mm) under fertilizer treatments

4.1.8. Flower height (mm)

A noticeable variation in the height of flower was recorded due to application of different levels of NP and vermicompost presented in Table 4.1. The longest flower (116,33 mm) was measured with V3, which was statistically similar with that of NP1, V1, and V2 and other treatment. The shortest flower (103,16 mm) was produced with control. It is presented from the results (Figure 4.8) that the increasing level of NP decreased the flower height of hyacinth and that the increasing level of vermicompost are increasing the flower height of hyacinth. A similar result was found that soil application of fertilizer increased flowering branch length as compared to its foliar application and no-fertilization on gladioli (Mohammadi et al., 2014). Sönmez et al., 2013) showed that the highest flower length (33,7 cm) were determined in barnyard manure application. On plant gladioli as well as, Turkoglu et al. (2008) observed that flower height, 18,38 mm on plant *Narcissus*.

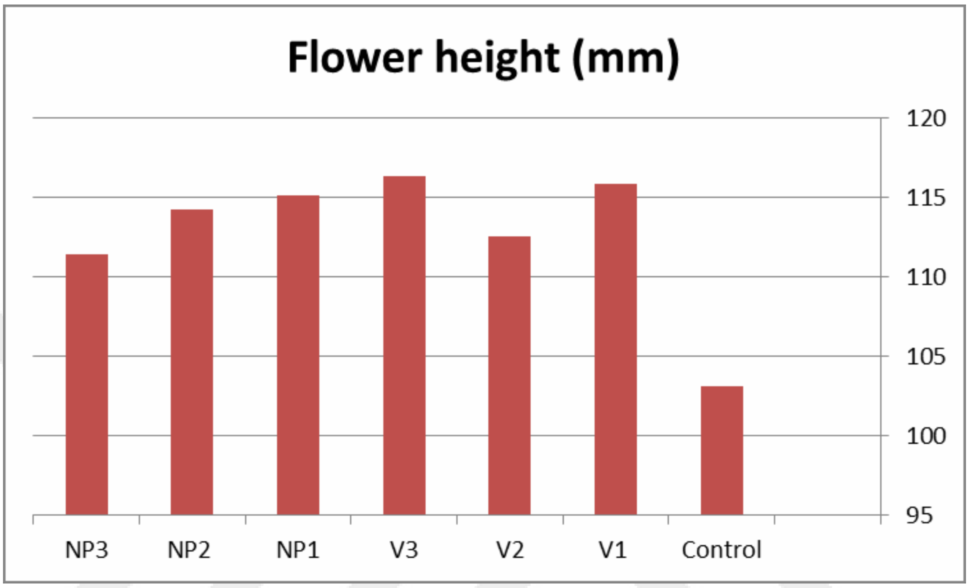

Figure 4.8. Flower height (mm) under fertilizer treatments

4.1.9. Flower diameter (mm)

Flower diameter was not significantly influenced by different levels of NP and vermicompost supplement (Table 4.1). The biggest flower diameter of 66,942 mm was found in plants grown under NP3 which was closely followed by V2, V1, NP1 and other treatment. The smallest flower diameter of 60,72 mm was recorded with the V3 closely flowed by control. It is clear from the results (Figure 4.9) that the increasing level of NP2 are increasing the flower diameter but increasing level of NP3 decreased flower diameter of *H. orientalis* and that the increasing level of V2, are increasing the flower diameter but the increasing level of V3, are decreased flower diameter of hyacinth. However, it was non-significant. On the other hand, Mohammadi et al. (2014) found that soil application of fertilizer increased flower diameter as compared to its foliar application and no-fertilization on gladioli.

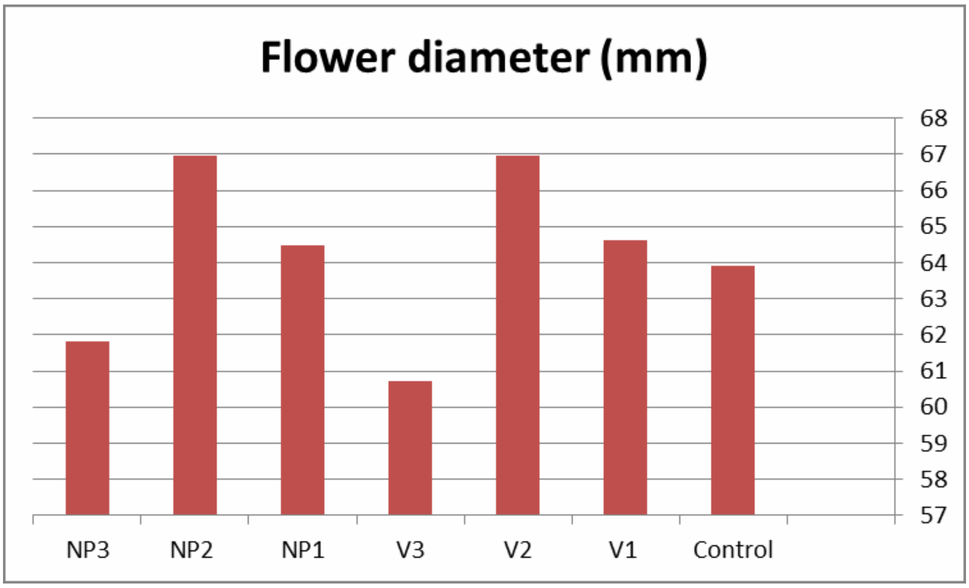

Figure 4.9. Flower diameter (mm) under fertilizer treatments

4.1.10. Floret height (mm)

Floret height of hyacinth was measured after full flowering time. It was observed that floret height was influenced not significantly by different levels of NP and vermicompost application (Table 4.1). The maximum floret (26,768 mm) was recorded in NP2 which was followed by and statistically similar with other treatment without control, and the minimum floret (24,080 mm) was found in control, non-significant different. It is presented from the results (Figure 4.10) that the increasing level of NP2, increasing the floret height but increasing level of NP3, decreased the floret height of *H. orientalis* and that the increasing level of V2, decreased the floret height but increasing level of V3, increasing the floret height of hyacinth but it was non-significant. Sönmez et al. (2013) showed that the highest floret length (89 mm) were determined in control on gladioli plant.

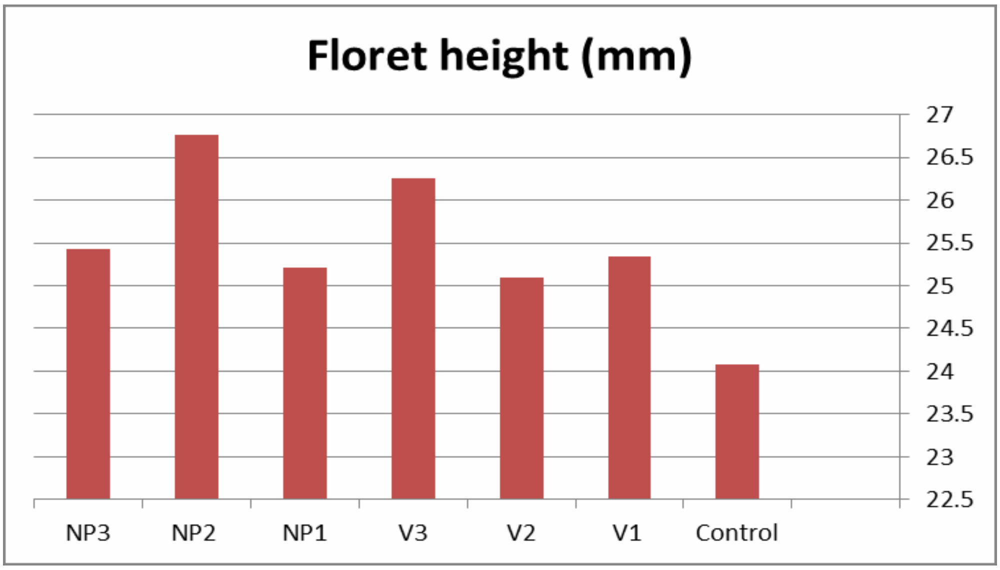

Figure 4.10. Floret height (mm) under fertilizer treatments

4.1.11. Floret Diameter (mm)

Floret diameter was not significantly influenced by different levels of NP and vermicompost presented in Table 4.1. The biggest floret diameter of 28,140 mm was found in plants grown under V1, which was closely flowed by other treatment without V3. The smallest floret diameter of 25,693 mm was recorded with the V3. It is presented from the results (Figure 4.11) that the increasing level of NP2, increasing the floret diameter but increasing level of NP3, decreased floret diameter of hyacinth flower. And that the increasing level of vermicompost is not increasing the floret diameter of hyacinth and it was non-significant different. Sönmez et al. (2013) showed that the highest floret width (77,8 mm) were determined in control on plant gladioli.

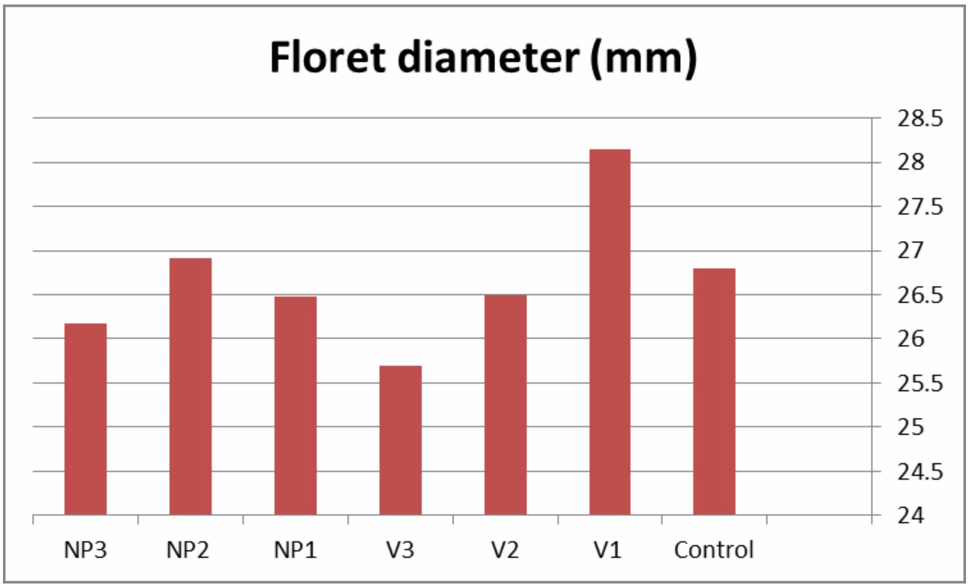

Figure 4.11. Floret diameter (mm) under fertilizer treatments

4.1.12. Floret number

Floret number was counted and no significant variation was found due to different levels of NP and vermicompost presented in Table 4.1. Floret number varied from 32,147 mm to 37,690 mm per plant. The maximum number of floret (37,690 mm) was recorded with the T1 which was statistically similar with NP2, V2, and control. The lowest number of floret per plant was noted with the V1, (32,147 mm) closely followed by NP3, V3. It is clear from the results (Figure 4.12) that the increasing level of NP increasing the floret number of hyacinth flower. And that the increasing level of V2, increasing the floret number but increasing level of V3, decreased the floret number of hyacinth and it was non-significant. The similar result recorded by Sultana et al. (2015). The rate effect of NP fertilizers was not found significant the production of flowers of *Zinnia* plant. Also, Mohammadi et al. (2014) found that soil application of fertilizer increased flower number as compared to its foliar application and no-fertilization on gladioli. A similar result Senthilkumar et al. (2004) concluded that the appropriate ratio application of vermicompost resulted in higher bud number, flower number, shoot weight, root weight and plant height, which is in agreement with our study. Sönmez et al. (2013) showed that the highest floret number (9,33), were obtained in peat application on *Gladiolus* plant.

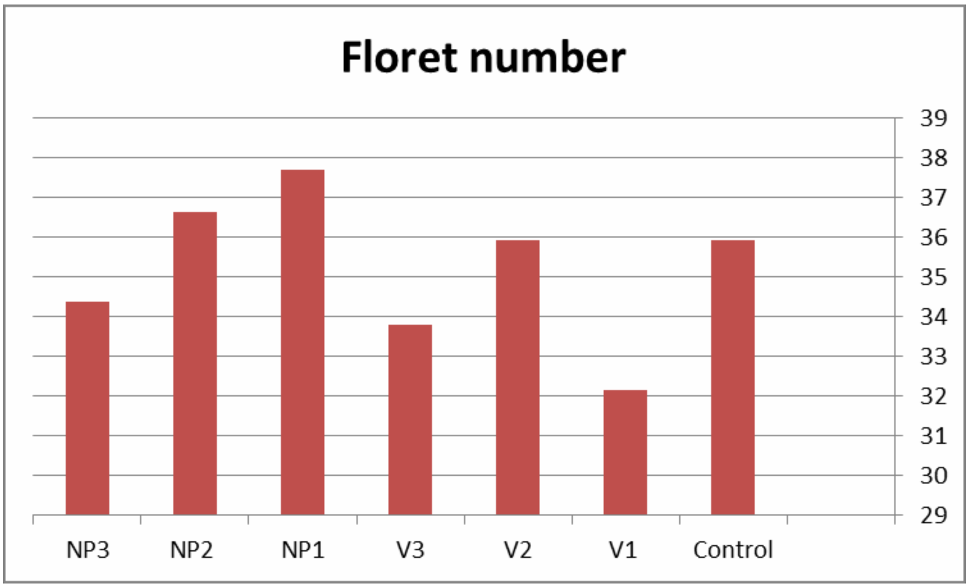

Figure 4.12. Floret number under fertilizer treatments

4.1.13. Stalk thickness (mm)

Stalk thickness for hyacinth was not significantly influenced by different levels of NP and vermicompost supplement (Table 4.1). The maximum stalk thickness of 13,507 mm was found in plants grown under V1, which was statistically similar with NP1. The smallest stalk thickness of 12,347 mm was recorded with the control and closely flowed by other treatment without V1, NP1. It is presented from the results (Figure 4.13) that the increasing level of NP decreased the stalk thickness of *H. orientalis.* And that the increasing level of vermicompost NP decreased the stalk thickness of *H. orientalis.* Also, Sönmez et al. (2013) showed that the highest stem diameter (8,07 mm) were determined in barnyard manure application on plant *Gladiolus.* As well as, Turkoglu et al. (2008) observed that 5,56 mm of stalk thickness on plant *Narcissus.* Padem and Alan (1995) observed that combined NPK applications may elevate the nitrogen, potassium and phosphorus contents and the increase in stalk length might be due to elevated levels of macronutrients which have a positive effect on floral characteristics on tomatoes.

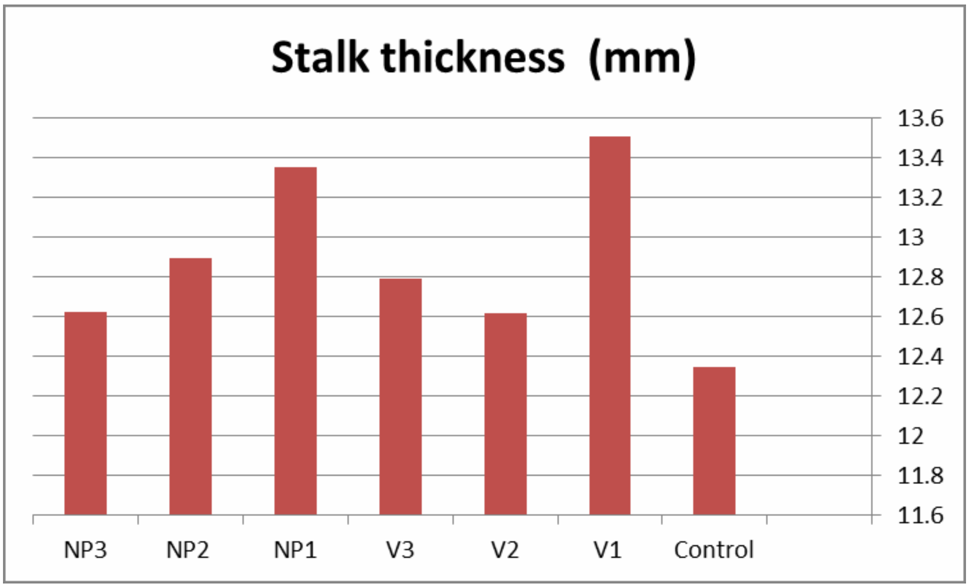

Figure 4.13. Stalk thickness (mm) under fertilizer treatments

4.2. Plant Nutrient Element Analysis

The macro nutrients are nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg). They are the most frequently required in a crop fertilization program. Also, they are need in the greatest total quantity by plants as fertilizer. Especially, they work "behind the scene" as activators of many plant functions.

Some of the micronutrients are boron, chlorine, copper, iron, manganese, molybdenum, and zinc. These plant nutrient elements are used in very small amounts, but they are just as important to plant development and profitable crop production as the major nutrients.

Table 4.2. Effects of NP and vermicompost fertilizers on the content of macro nutrient elements hyacinth leaves and bulbs

Organs	Applications	Nitrogen N (%)	Phosphorus P (%)	Potassium K (%)	Calcium Ca (%)	Magnesium Mg (%)
Leaf	Control	4,177 A**	0,269 B**	3,112 D**	0,788	0,239
	V1	3,420 B	0,291 B	3,931 CD	0,775	0,264
	V2	4,247A	0,356 B	4,630 C	0,940	0,307
	V3	4,450 A	0,603 A	6,758 A	1,095	0,346
	NP1	4,297A	0,352 B	4,645 C	0,909	0,307
	NP2	3,633 B	0,345 B	5,586 B	1,043	0,291
	NP3	2,403 C	0,351 B	5,592 B	1,130	0,330
	Sign. value	p<0,01	p<0,01	p<0,01	NS	NS
Bulb	Control	1,087	0,191 D**	0,833 B*	0,321	0,107
	V1	1,140	0,214 CD	0,900 B	0,287	0,096
	V2	1,266	0,247 BC	0,817 B	0,316	0,102
	V3	1,713	0,337 A	1,183 A	0,372	0,119
	NP1	1,290	0,255 BC	0,871 B	0,370	0,101
	NP2	1,310	0,271 B	0,992 B	0,372	0,112
	NP3	1,063	0,279 B	0,952 B	0,290	0,089
	Sign. value	NS	p<0,01	p<0,05	NS	NS

*significant at 0,05 level, **significant at 0,01 level, ns: non significant.

4.2.1. Nitrogen (N) content (%)

The effects of vermicompost and NP applications on nitrogen contents of hyacinth leaves were found significant statistically (p<0,01) (Table 4.2). Nitrogen concentration in leaf of *Hyacinthus orientalis* varied from 4,450 % to 2,403 % over the treatments The highest N concentration for leaf (4,450 %) it was recorded in the treatment V3 and the lowest N concentration for leaf (2,403 %) it was recorded in the treatment NP3. N concentration in bulb of *Hyacinthus orientalis* varied from 1,713 % to 1,063 % over the treatments. The effects of vermicompost and NP applications on nitrogen contents of hyacinth bulbs were found not significant (Table 4.2). The highest N concentration for bulb (1,713 %) it was recorded in the treatment V3 and the lowest N concentration for bulb (1,063 %) it was recorded in the treatment NP3 it is showed from the results Figure 4.14 and Table 4.2 meaning increasing level of vermicompost increasing nitrogen on leave and bulb but increasing level of NP decreasing nitrogen on leave and bulb. Because the plant collects nutrients and minerals from the soil through its roots, plants make food in their leaves.

The leaves contain a pigment called

chlorophyll, which colors the leaves green. Chlorophyll can make food the plant can use from carbon dioxide, water, nutrients, and energy from sunlight. Hedge (1988) stated that N fertilization increased the N, Ca, and Mg concentrations in the bulb of onion. Coolong et al. (2004) stated that in onion bulbs N and P content was increased by N application. These results were in agreement with earlier reports on nutrient concentration and uptake was increased due to fertilization of crop Nakashgir et al. (2000).

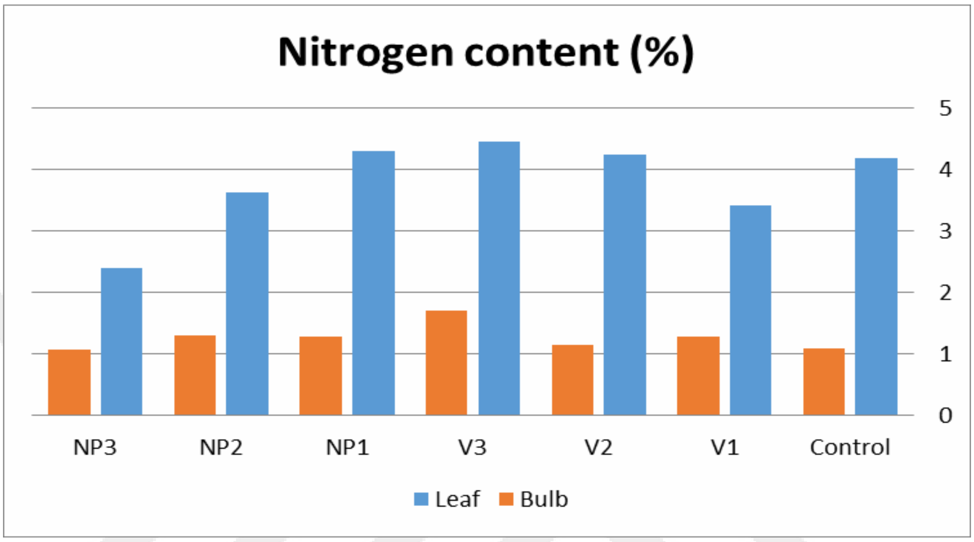

Figure 4.14. Nitrogen content (%) in leaf and bulb of hyacinth

4.2.2. Phosphorus (P) content (%)

The effects of vermicompost and NP applications on phosphorus contents of hyacinth leaves were found significant statistically ($p<0,01$) (Table 4.2). Phosphorus concentration in leaf of *Hyacinthus orientalis* varied from 0,603 % to 0.269 % over the treatments. The highest P concentration for leaf (0,603 %) it was recorded in the treatment V3 and the lowest P concentration for leaf (0,269 %) it was recorded in the treatment control. The effects of vermicompost and NP applications on phosphorus contents of hyacinth bulbs were found significant statistically ($p<0,01$) (Table 4.2). Phosphorus concentration in bulb of *Hyacinthus orientalis* varied from 0,337 % to 0,191 % over the treatments The highest P concentration for bulb (0,337 %) it was recorded in the treatment V3 and the lowest P concentration for bulb (0,191 %) it was recorded in the control treatment. It is showed from the results Figure 4.15 and Table

4.2 meaning increasing level of vermicompost increasing P on leave and bulb but increasing level of NP decreasing P on leave and bulb. Because P involved in photosynthesis, respiration, energy storage and transfer, cell division, and enlargement and promotes early root formation and growth; improves quality of fruits, vegetables, and grains, vital to seed formation; helps plants survive harsh winter conditions; increases water-use efficiency.

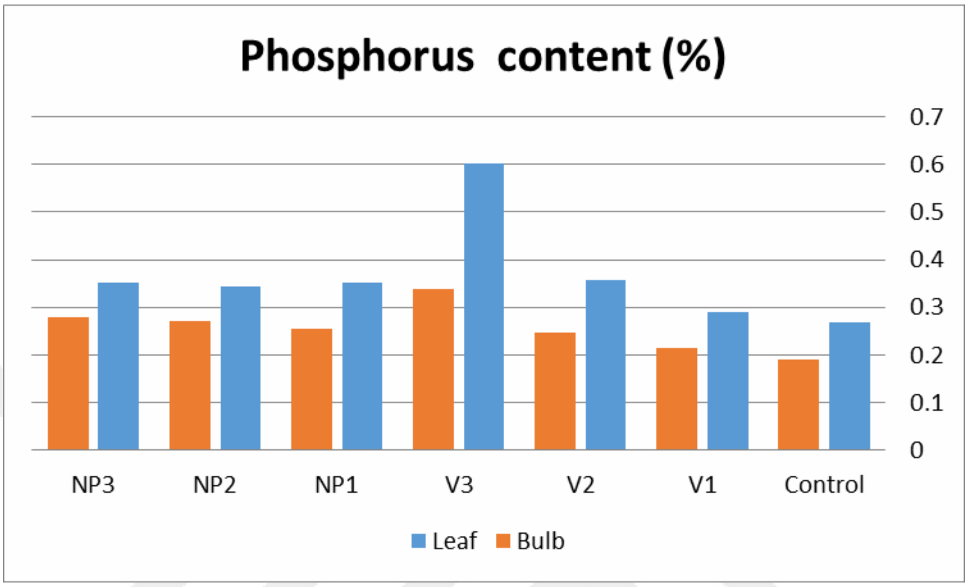

Figure 4.15. Phosphorus content (%) in leaf and bulb of hyacinth

4.3.3. Potassium (K) content (%)

The effects of vermicompost and NP applications on potassium contents of hyacinth leaves were found significant statistically ($p<0,01$) (Table 4.2). Potassium concentration in leaf of hyacinth varied from 6,758 % to 3,112 % over the treatments. The highest K concentration for leaf (6,758 %) it was recorded in the treatment V3 and the lowest K concentration for leaf (3,112 %) it was recorded in control thetreatment. The effects of vermicompost and NP applications on K contents of hyacinth bulbs were found significant statistically ($p<0,05$) (Table 4.2). K concentration in bulb of *Hyacinthus orientalis* varied from 1,183 % to 0,833% over the treatments. The highest K concentration for bulb (1,183 %) it was recorded in the treatment V3 and the lowest K concentration for bulb (0,833 %) it was recorded in the treatment control. It is showed from the results Figure 4.16 and Table 4.2 meaning increasing level of vermicompost increasing K on leave and bulb but increasing level of NP increasing K on leave and bulb. Because potassium carbohydrate metabolism and the break down and translocation of starches; increases photosynthesis; increases water-use efficiency, essential to protein synthesis, important in fruit formation; activates enzymes and controls their reaction rates. Boyhan et al. (2007) studied that significant linear increase in K content of onion leaves and bulbs with increasing N fertilizer was recorded that peaked with 140 kg/ha N fertilizer. Also, Gülser et al. (2016) showed that, the highest K contents of hyacinth bulbs were K (9,72 %) in control while the highest K (2,41 %), contents of hyacinth leaves were found in control treatments.

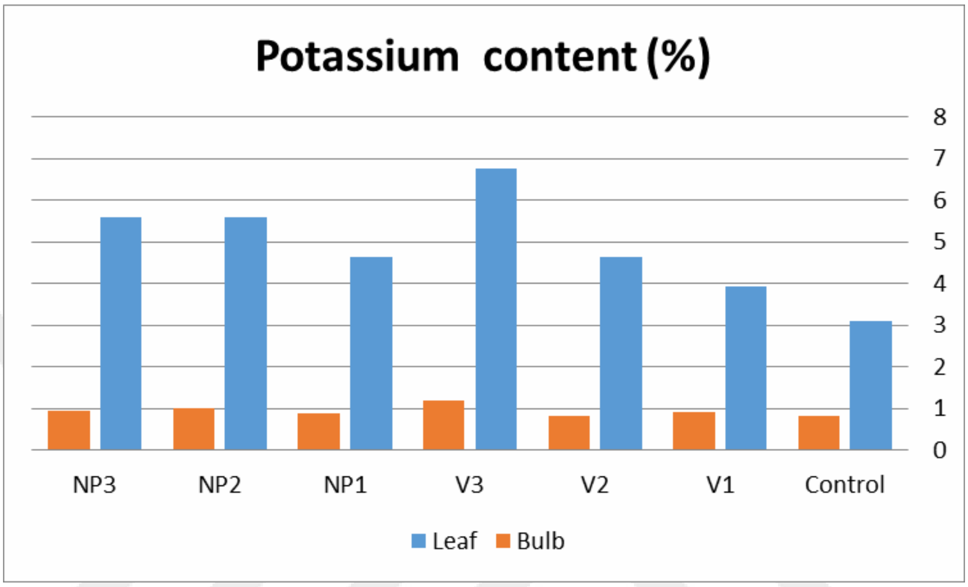

Figure 4.16. Potassium content (%) in leaf and bulb of hyacinth

4.2.4. Calcium (Ca) content (%)

The effects of vermicompost and NP applications on calcium contents of hyacinth leaves were found not significant statistically (Table 4.2). Ca concentration in leaf of *Hyacinthus orientalis* varied from 1,130 % to 0,775 % over the treatments. The highest Ca concentration for leaf (1,130 %) it was recorded in the treatment NP3 and the lowest Ca concentration for leaf (0,775 %) it was recorded in the treatment V1. The effects of vermicompost and NP applications on Ca contents of hyacinth bulbs were found not significant statistically (Table 4.2). Ca concentration in bulb of hyacinth varied from 0,372 % to 0,287 % over the treatments. The highest Ca concentration for bulb (0,337 %) it was recorded in the treatment V3 and NP2, and the lowest Ca concentration for bulb (0,287 %) it was recorded in the treatment V1, it is showed from the results Figure 4.17 and Table 4.2 meaning increasing level of vermicompost increasing Ca on leave and bulb but increasing level of NP increasing Ca on leave and bulb. Because Ca utilized for continuous cell division and formation, involved in nitrogen metabolism; reduces plant respiration; aids translocation of photosynthesis from leaves to fruiting organs; stimulates microbial activity. Gülser et al. (2016) showed that, the highest Ca contents of hyacinth bulbs were Ca (2,69 %) were in 40 mg kg^{-1} and 80 mg kg^{-1} in control while, the highest Ca (4,82 %), contents of leaves were obtained in lead-contaminated media.

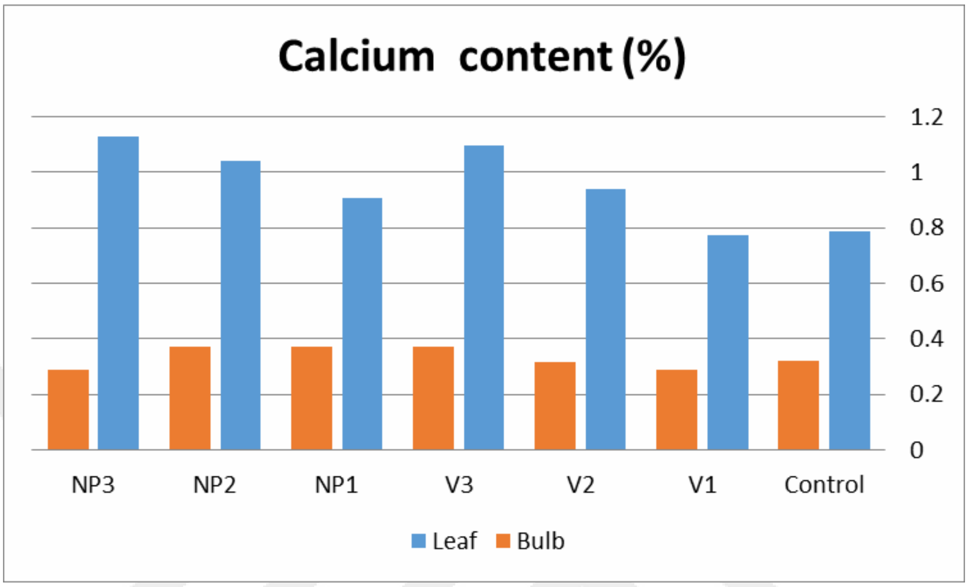

Figure 4.17. Calcium content (%) in leaf and bulb of hyacinth

4.2.5. Magnesium (Mg) content (%)

The effects of vermicompost and NP applications on Mg contents of hyacinth leaves were found not significant statistically (Table 4.2). Mg concentration in leaf of *Hyacinthus orientalis* varied from 0,346 % to 0,239 % over the treatments. The highest magnesium concentration for leaf (0,346 %) it was recorded in the treatment V3 and the lowest magnesium concentration for leaf (0,239 %), it was recorded in the treatment control. The effects of vermicompost and NP applications on Mg contents of hyacinth bulbs were found not significant statistically (Table 4.2). Magnesium concentration in bulb of *Hyacinthus orientalis* varied from 0,11 9% to 0,96 % over the treatments The highest Mg concentration for bulb (0,119 %) it was recorded in the treatment V3, and the lowest Mg concentration for bulb (0,96 %) it was recorded in the treatment V1, it is showed from the results Figure 4.18 and Table 4.2 meaning increasing level of vermicompost increasing Mg on leave and bulb but increasing level of NP increasing Mg on leave and bulb. Because Mg, key element of chlorophyll production; improves utilization and mobility of phosphorus; activator and component of many plant enzymes; influences earliness and uniformity of maturity. Gülser et al. (2016) were obtained the highest Mg, Fe and Cu contents of hyacinth bulbs as 0,59 %. On the other hand, the highest Mg (1,46 %) contents of hyacinth leaves were obtained in control treatments.

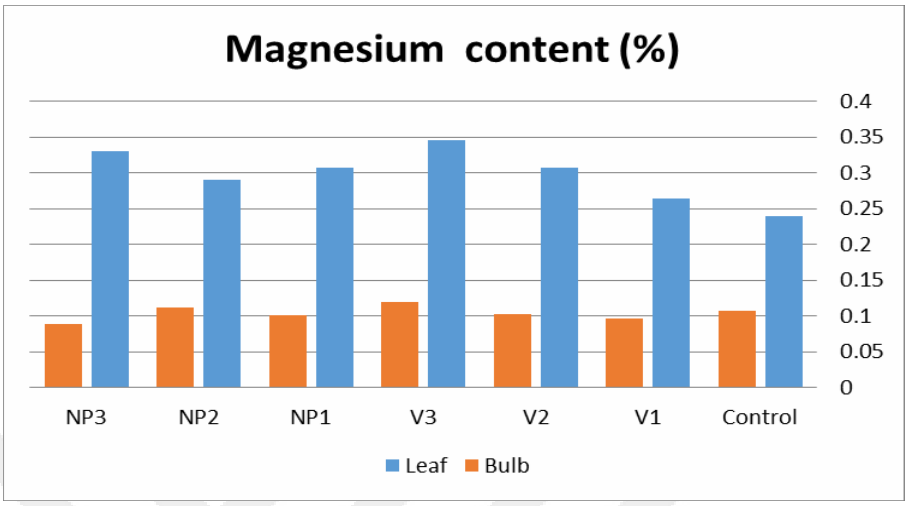

Figure 4.18. Magnesium content (%) in leaf and bulb of hyacinth

Table 4.3. Effects of NP and vermicompost fertilizers on the content of macro nutrient elements in the hyacinth leaves and bulbs

Organs	Applications	Fe (mg kg-1)	Mn (mg kg^{-1})	Zn (mg kg-1)	Cu (mg kg^{-1})
Leaf	Control	879,318 D**	46,253 C**	24,263 BC**	8,582 B**
	V1	1120,053 BC	63,677BC	33,560 A	8,990 B
	V2	1160,380 BC	63,011 BC	29,126 AB	9,936 B
	V3	802,333 D	86,200 A	15,148 D	18,616 A
	NP1	1193,216 B	61,756 C	21,103 CD	9,663 B
	NP2	1045,499 C	66,017 BC	19,326 CD	10,939 B
	NP3	1520,657 A	88,585 B	16,760 CD	8,652 B
	Sign. value	p<0,01	p<0,01	p<0,01	p<0,01
Bulb	Control	482,209 A**	20,812	16,453 B**	6,079
	V1	399,015 AB	23,374	18,556 A	6,949
	V2	389,360 AB	18,843	8,414 C	4,711
	V3	479,346 A	22,475	10,493 C	5,108
	NP1	352,638 B	21,844	7,39 C	6,810
	NP2	388,173 AB	20,106	10,523 C	5,140
	NP3	169,540 C	12,410	15,902 B	5,382
	Sign. value	p<0,01	NS	p<0,01	NS

**significant at 0,01 level, ns: non significant.

4.2.6. Iron (Fe) Content (mg kg^{-1})

The effects of vermicompost and NP applications on Fe contents of hyacinth leaves and bulbs were found significant statistically (p<0,01) (Table 4.3). Fe concentration in leaf of *Hyacinthus oriantalis* varied from 1520,657 mg kg^{-1} to 879,318 mg kg^{-1} over the treatments. The highest iron concentration for leaf (1520,657 mg kg^{-1}) it was recorded in the treatment NP3, and the lowest iron concentration for leaf (879,318 mg kg^{-1}) it was recorded in the treatment control. Fe concentration in bulb of hyacinth varied from 482,209 mg kg^{-1} to 169,450 mg kg^{-1} over the treatments. The highest Fe concentration for bulb (482,209 mg kg^{-1}) it was recorded in the treatment control, and the lowest Fe concentration for bulb (169,450 mg kg^{-1}) it was recorded in the treatment NP3, it is showed from the results Figure 4.19 and Table 4.3. Meaning increasing level of vermicompost randomly increasing Fe on leave and bulb but increasing level of NP randomly increasing Fe on leave and bulb, because Fe is essential of germination of pollen grains and growth of pollen tubes; essential for seed and cell wall formation; necessary for sugar translocation; affects nitrogen and carbohydrate. Çığ and Gülser (2015) reported that on plant daffodil (*Narcissus tazetta* L.). The highest Fe contents in the roots are observed as 3239,70 ppm, while the highest Fe content is determined in salt + mycorrhiza treatment as 138,92 ppm. And the highest Fe contents in the bulbs are found in salt treatment as 34,10 ppm. Gülser et al. (2016) reported that the highest Fe contents of hyacinth bulbs were obtained as 36,00 mg kg^{-1} in control On the other hand the highest Fe (129,86 mg kg^{-1}) contents of hyacinth leaves were obtained in control.

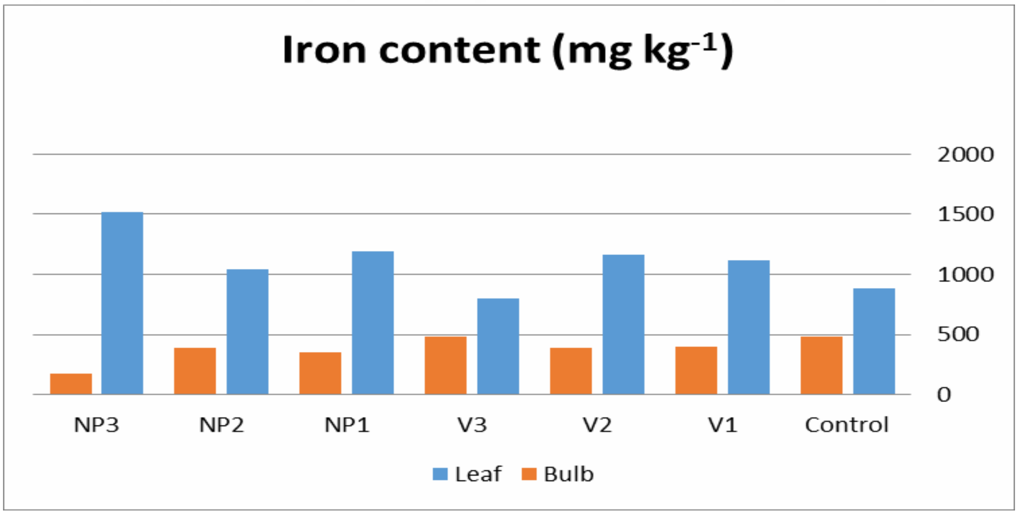

Figure 4.19. Iron content (mg kg^{-1}) in leaf and bulb of hyacinth

4.2.7. Manganese (Mn) content (mg kg^{-1})

The effects of vermicompost and NP applications on Mn contents of hyacinth leaves were found significant statistically ($p<0,01$) (Table 4.3). Mn concentration in leaf of

Hyacinthus orientalis varied from 86,2000 mg kg^{-1} to 46,253 mg kg^{-1} over the treatments. The highest Mn concentration for leaf (88,585 mg kg^{-1}) it was recorded in the treatment NP3, and the lowest Mn concentration for leaf (46,253mg kg^{-1}) it was recorded in the treatment control. The effects of vermicompost and NP applications on Mn contents of hyacinth bulbs were found not significant statistically (Table 4.3). Mn concentration in bulb of hyacinth varied from 22,475 mg kg^{-1} to 12,410 mg kg^{-1} over the treatments. The highest Mn concentration for bulb (22,475 mg kg^{-1}) it was recorded in the treatment V3, and the lowest Mn concentration for bulb (12,410 mg kg^{-1}). It was recorded in the treatment NP3, it is showed from the results (Figure 4.20) (Table 4.3). Meaning increasing level of vermicompost increasing Mn on leave and bulb but increasing level of NP increasing Mn on leave and bulb**,** because Mn functions as a part of certain enzyme systems; aids in chlorophyll synthesis. Çığ and Gülser (2015) reported that on plant daffodil (*Narcissus tazetta* L.) the highest Mn content is determined as 230,68 ppm, in the leaves is found in mycorrhiza treatment as 0,88 µg/mg while the highest the highest Mn content in the leaves is obtained in NaCl treatment as 22,55 ppm; the highest Mn content in the bulbs is found in another salt treatment as 15,15 ppm respectively.

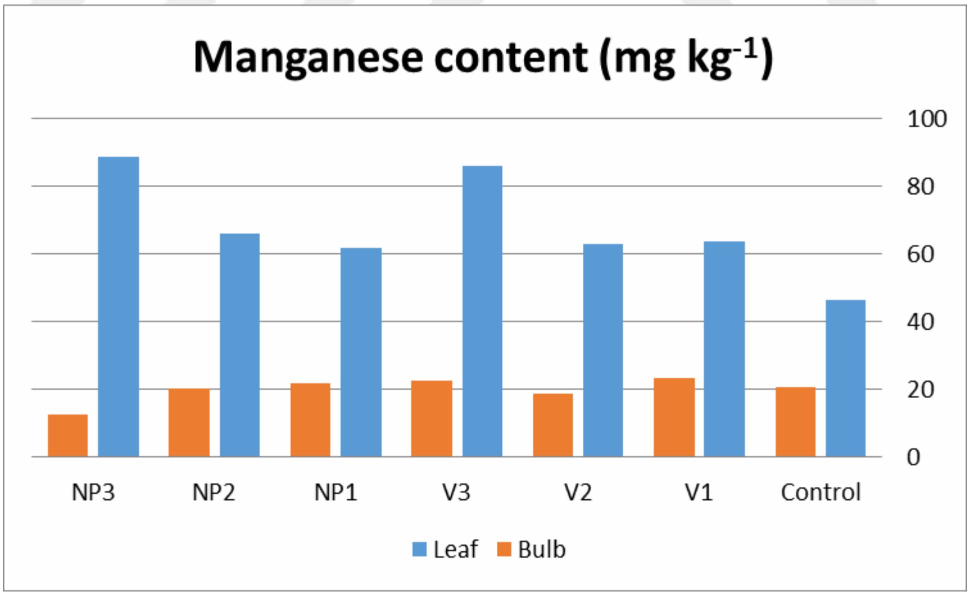

Figure 4.20. Manganese content (mg kg^{-1}) in leaf and bulb of hyacinth

4.2.8. Zinc (Zn) Content (mg kg^{-1})

The effects of vermicompost and NP applications on Zn contents of hyacinth leaves and bulbs were found significant statistically ($p<0,01$) (Table 4.3). Zn concentration in leaf of *Hyacinthus orientalis* varied from 33,560 mg kg^{-1} to 15,148 mg kg^{-1} over the treatments. The highest Zn concentration for leaf (86,2000 mg kg^{-1}) it was recorded in the treatment V1, and the lowest Zn concentration for leaf (33,560 mg kg^{-1}) it was recorded in the treatment V3. Zn concentration in bulb of hyacinthus varied from 18,556 mg kg^{-1} to 7,39 mg kg^{-1} over the treatments. The highest Zn concentration for bulb (18,556 mg kg^{-1}) it was recorded in the treatment V1, and the lowest Zn, concentration for bulb (7,39 mg kg^{-1}) it was recorded in the treatment NP1, it is showed from the results Figure 4.21 and Table 4.3. Meaning increasing level of vermicompost decreased Zn on leave and bulb but increasing level of NP decreased Zn on leave and bulb**,** because Zn necessary for chlorophyll production; necessary for carbohydrate formation; necessary for starch formation.

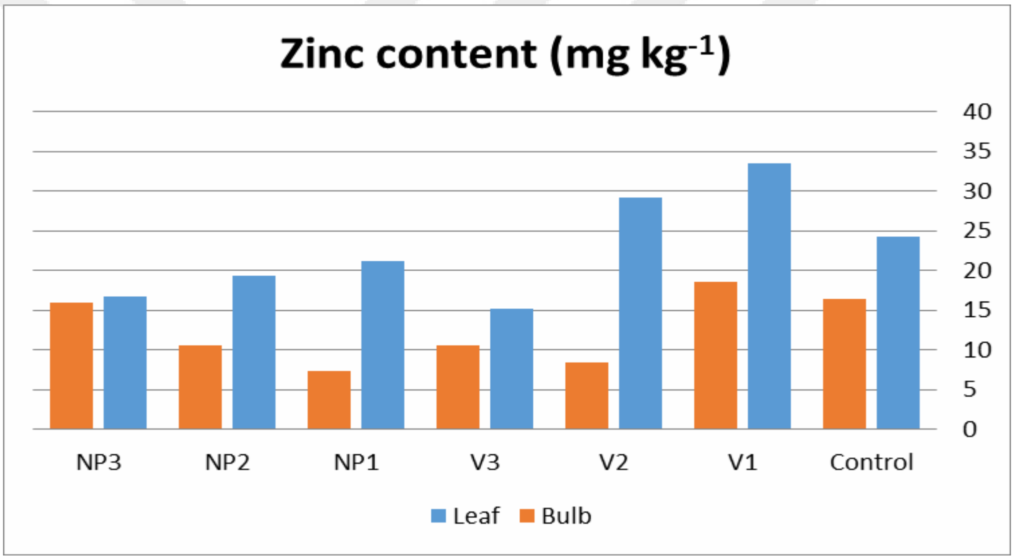

Figure 4.21. Zinc content (mg kg^{-1}) in leaf and bulb of hyacinth

Çığ and Gülser (2015) reported that on plant daffodil (*Narcissus tazetta* L.), the highest Mn, Zn and Cu contents are determined as 230,68 ppm, 38,67 ppm and 71,92 ppm in salt + mycorrhiza treatment respectively contents in the leave while the highest Zn content is determined in salt treatment as 56,15 ppm while the highest Cu concentration is analyzed as 30,45 ppm in control treatment contents in the bulbs. As well as, Gülser et al. (2016) showed that, the highest Zn (32,27 mg kg^{-1}) contents of hyacinth leaves were obtained in control. On the other hand, the highest Zn (50,14 mg kg-1) contents of bulb were obtained in lead contaminated media.

4.2.9. Copper (Cu) Content (mg kg^{-1})

The effects of vermicompost and NP applications on Cu contents of hyacinth leaves were found significant statistically (p<0,01) (Table 4.3). Cu concentration in leaf of hyacinth varied from 18,616 mg kg^{-1} to 8,582 mg kg^{-1} over the treatments. The highest Cu concentration for leaf (18,616 mg kg^{-1}) it was recorded in the treatment V3, and the lowest Cu concentration for leaf (8,582 mg kg^{-1}) it was recorded in the treatment control. The effects of vermicompost and NP applications on copper contents of hyacinth bulbs were found not significant statistically (Table 4.3). Cu concentration in bulb of *Hyacinthus orientalis* varied from 6,949 mg kg^{-1} to 4,711 mg kg^{-1} over the treatments. The highest copper concentration for bulb (6,949 mg kg^{-1}) it was recorded in the treatment V1, and the lowest copper, concentration for bulb (4,711 mg kg^{-1}) it was recorded in the treatment V2, it is showed from the results Figure 4.21 and Table 4.3. Generally increased Fe and Zn contents and decreased of Cu content of hyacinth leaves and bulbs because Cu catalyzes several plant processes; major function in photosynthesis; major functionin reproductive stages indirect role in chlorophyll production; increases sugar content.

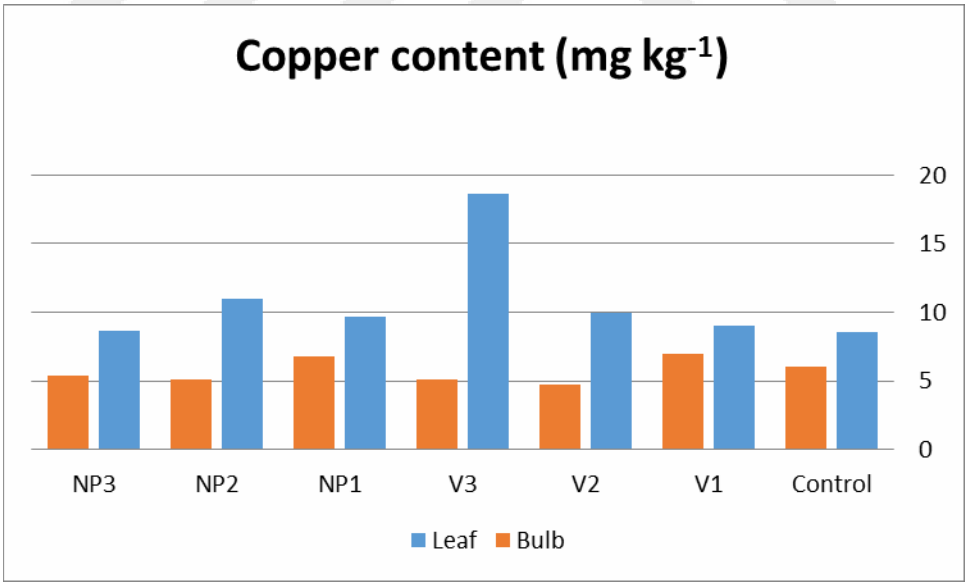

Figure 4.22. Copper content (mg kg^{-1}) in leaf and bulb of hyacinth

Gülser et al. (2016) showed that, the highest Cu content of hyacinth bulbs was 3,40 mg kg^{-1} in control while the highest Cu (13,75 mg kg^{-1}) content of leaves was obtained in lead-contaminated media. Also Çığ and Gülser (2015) reported that on plant daffodil (*Narcissus tazetta* L.) the highest Mn, Zn and Cu contents were determined as 230,68 ppm, 38,67 ppm and 71,92 ppm in salt + mycorrhiza treatment respectively contents in the leaves, while the highest Zn content was determined in salt treatment as 56,15 ppm, while the highest Cu concentration was analyzed as 30,45 ppm in control treatment contents in the bulbs.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

Based on this results on this present study concerning the effects of dosages of vermicompost and np on plant growth and nutrient content of hyacinth (*Hyacinthus* sp.*)* in ecological conditions of Siirt. The following conclusion can be drawn; the V1 (25 g vermicompost) less effective on some parameter of *Hyacinthus orientalis* like plant height and floret diameter but it was a good result on other parameter but V2 (50 g vermicompost) gives the more effective to increasing the plant height and floret number but decreasing the flower height and other parameters; also V3 (75 g vermicompost) gives the more effective to increasing the plant height and flower height as much as the NP1 less effective on first flowering time, full flowering time, plant height, leaf number, floret diameter, floret height but it is a good result on other parameter like harvest time, leaf diameter, leaf height, flower height, floret number also NP2 less effective on first flowering time, full flowering time, harvest time, leaf height, leaf diameter, plant height, flower height, stalk thickness but it is good result on flower diameter, floret height, floret diameter and also NP3 less effective on the some parameter floret number, stalk thickness, flower height, flower diameter, floret height. But it is recorded a good result on plant height, flower height and other parameter meaning increasing level of NP, gives the more effective to increasing the plant height but decreasing the flower height and floret number and other parameters. The highest N concentration for leaf (4,450 %) is recorded in the treatment V3 and the highest N concentration for bulbs (1,713 %) is recorded in the treatment V3.

5.2. Recommendation

In Siirt province there is no commercial production in terms of cut flowers, bulbous ornamental plants, indoor or outdoor ornamental plants. However, due to its climate structure, Siirt province is suitable for growing many ornamental plants. Depending on the conclusions mentioned previously, the highest plant (179,547 mm) it was obtanied in NP3 and the highest flower height (116,33 mm) it was obtanied in V3, and the highest stalk thickness (13,507 mm) it was obtanied in V1 and the highest micro and macro nutrent contents on leave and bulb it was recorded in V3 meaning the best treatment for plant growing and nutrient content on *Hyacinthus orientalis* on ecological of Siirt ecological condition it was V3 and NP3.

The following points of view can be recommended: in organic fertilizer are no longer used, instead organic and biological fertilizers are used. Because when inorganic fertilization is done excessively it accumulates as a salt in the soil, witch causes environmental contamination. In the first place plants are damaged but infect all living things are in short, environmental damage. as seen in our study, the results obtained from the nitrogen and phosphorus fertilization give the same result as the ones useful to the worm fertilizer and even give better results in some (flower criteria), and the positive effect of vermicompost was clearly in the hyacinths growing in Siirt ecological conditions. It maybe desirable to use vermicompost for ornamental plant growing. Vermicompost use as organic as it the same time it is seen as positive for living microorganism and due to environmental by using different doses it is expected that the plant will be served and accordingly developed and high quality is obtained.

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