CHAPTER ONE

INTRODUCTION

Grapes, (*Vitisvinifera* L.), is a member of the family Vitaceae and is the most widely grown species of this family (Reisch and Pratt, 1996). It is perennial, deciduous and woody vine native to the Mediterranean rigon but can be grown under irrigation in desert areas and tropical and sub-tropical climatic conditions (Lavee 2000). Grapes are one of the most important fruit crops grown in the world today in terms of total acreage and production valued for their fruits(FAO 2010). The United States is the center of origin of many species of grape. The vines have tenderls for support. Species differ in leaf shape, color, margin, and surface. Flower is an inflorescence located opposite to a leaf. Grape cultivars are generally classified according to the use (wine,raisin, juice or fresh fruit), or according to origin (European grapes, American grapes, French grapes and Muscadine grapes)(Acquaah ,*et.al.*,2002). Grapes can tolerate a wide range of soil types but performs best on deep, loamy soils with high organic matter content and good structure with pH of 6.5-7.0 (Jakson, 2011).The commercial varieties are seedy or seedless and in different colors such as red, green, back or blue, and with different shapes and sizes. The fruits contain 70-80% water, 15-25% carbohydrates, 0.3-1.5%organic acids, 0.001-0.1% protein, 0.3-0.6% minerals and many vitamins (Kadam, 1995).

Propagation is by budding, grafting, cutting or layering (Hartmann, *et al.*2002). The top producing countries in the world are China, Italy, France and Spain (FAO, 2010). The world production of grape is estimated at about 60 million ton, 80% wine, 13% used fresh, 7% raisins. The cultivation of grape inSudan is limited. Yields are of low quality and quantity. The introduction of grapes date back to the 17^{th} century where grape vines were reported in Marawi , Dungola , Blue Nile , White Nile , Marah Mountain , North Darfur and Khartoum State (General Department of Technology Transfer and Extention , Khartoum State, .2013) .The commercially important cultivars worldwide are Flaem, Cardinal, Thompson Seedless, Razegi, Crimson, Emperor, Dr. Night, Sultani, and Halawi(Salunkhe and Kadam, 2005) In Sudan grapes production was not improve, due to lack of knowledge and experience concerned with cultural practices especially fertilization and the pruning practices: when and how to do it?

The Bio-activator Elixir is an organic fertilizer that contains a number of determined beneficial micro-organisms which lives in the soil, water and plant residues and remains of plants. The micro-organisms work on the conversion of the available elements of the plants residues into available ionic forms ready for absorption by plant. Elixir also contains high amounts of micro- and macro elements available to the plants and works on plant nutrition and improve the physiological and biological properties and natural structure of the soil and restore the living funa of the soil by increasing the number of micro-organisms and beneficial worms andpreserve the ecological balance and biodiversity of these organisms (Bio-activator Factory for Agricultural fertilizers).

The presence of salts in irrigation water and soils is a hurdle for agricultural development in many countries around the world. Saline soils are mostly confined to arid and semi-arid regions mainly because of high water evaporation, inadequate rain, saline irrigation water, high water table, poor drainage and improper alignment of irrigation canals.

The term salt- affected soil is generally used to indicate saline, saline sodic and sodic soils. The effect of salt on plant growth is due to high osmotic potential, nutrient imbalance and presence of some ions in toxic quantities. Proper management in these soils is necessary for higher production and productivity. The important problems which have direct effected on the nutrition of plant on saline soils are low fertility, high osmotic potential, reduced availability of nutrients, poor air and water movement and low microbial activity (Toba,*et.al*, 2004).

The objective of this study was to increase productivity of grapevine in terms of quantity and quality by using a commercial organic bio-activator (Trade named “Exilir”) that have properties toimprovethe physical and chemical properties of soils.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction :

Grapes (*Vitis* spp.) members of the family *Vitaceae* are divided into two subgenera, *Euvitis*Planch. And*Muscadinia* Planch (Einset and Pratt,1975). The family has about 900 species grouped into 14 genera among which only *Vitis* produces fruits. Species of American (*Vitislabrasca*L.) and European (*Vitisvinifera* L.) origins, standout for their high economic value in two different markets: table and wine grape production. V. *vinifera* is the most widely grown species of the European grapes. The only commercial representative from *Mascadinia,* genus (American grape), is V. *rotundifolia* or muscadine grape (Acquaah,2002).

2.2. Plant nutrition:

Carbon forms the backbone of most plant bio-molecules, including proteins, starches and cellulose. Carbon is fixed through photosynthesis; this converts carbon dioxide from the air into carbohydrates which are used to store and transport energy within the plant (Norman,2010).

Hydrogen also is necessary for building sugars and building the plant. It is obtained almost entirely from water. Hydrogen ions are imperative for a proton gradient to help drive the electron transport chain in photosynthesis and for respiration (Norman, 2010).

Oxygen is a component of many organic and inorganic molecules within the plant, and is acquired in many forms. These include: O_2 and CO_2 (mainly from the air via leaves) and H_2O, NO_3^- , $H_2PO_4^-$ and SO_4^{2-} (mainly from the soil water via roots). Plants produce oxygen gas (O_2) along with glucose during photosynthesis but then require O_2 to undergo aerobicellular respiration and break down this glucose to produce ATP(Norman, 2010) .

The survivability of all plants requires certain minerals nutrients. These mineralsoccur naturally in the soil and are taken up with by the roots of plants. An appreciable number of minerals are gradually used by the plants or are washed down the soil away from the root zones of plants necessitating replacementto maintain optimal growth and development of plants. Most fertile soils have enough of these minerals to sustain plant growth and development (Hawai, 2011).

All plants,grown in the fields or in containers need inorganic minerals for growth and development. Weathering of mineral rocks, decaying of organic matter, animals and soilmicro-organisms are involved in complex interactions to form inorganic minerals in the soil. Mineral nutrient absorbed by roots as ions dissolved in soil water. Many factors affect minerals availability to plant. The most important of these factors are alkalinity ofsoils with too high pH and acidic soils with too low pH. Ions can readily be available to roots or could be tied up by other elements or soil particles (Jones, *et al.*,2012). For optimum grape vine growth and yield, the soil must contain a adequate amounts of macronutrients such as nitrogen, potassium, phosphorus and magnesium (Kurtural ,2012). Bratasevec*et al*., (2013) evaluated the effects of soil and foliar fertilization on mineral contents in the leaves of ”Rebuala” grapevine cultivar and found that N fertilization increased yield and improve grape vine quality, and that fertilization with K decreased Mg uptake almost to half relative to the control.

Akina *et al*.,(2012), reported that foliar fertilizeris highly important for improving yield and quality of grape vine, significantly increasing quality parameters such as berry length, berry weight and maturity. In an experiment where different nitrogen rates combined with different potassium levels (Abd El-Razed, *et al*., 2011) found that high N fertilization improved vegetative growth. The only effect of high K fertilization was an increase in total soluble solids and a decrease in acid concentration. Macro and micro nutrientsinfluence the physiological and metabolic processes involved with grapevine growth and production. (Elements such as nitrogen, phosphorous, potassium, magnesium, boron, zinc, manganese, iron and copper play important roles in vine growth and development and consequently yield and quality of the product).Fertilizer programs should aim to address individual elements deficiencies experienced by vines to ensure balanced growth between foliage and crop yields, rapid ripening of fruits and promote product quality (Asheley, 2011).In an experiment where different nitrogen rates combined with different potassium levels Abd El-Razed, *et al*.,(2011) found that high N fertilization improved vegetative growth. The only effect of high K fertilization was an increase in total soluble solids and a decrease in acid concentration.

2.3 Inorganic fertilizers:

There are 16 elements that are known to be essential mineral nutrients for plants. In relatively large amounts, the soil supplies nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur; these are often called the macronutrients. In relatively small amounts, the soil supplies iron, manganese, boron, molybdenum, copper, zinc, chlorine, and cobalt, the so-calledmicronutrients. Nutrients must be available not only in sufficient amounts but also in appropriate ratios (Norman, 2010).

Plant nutrition is a difficult subject to understand completely, partially because of the variation between different plants and even between different species or individuals of a given clone. Elements present at low levels may cause deficiency symptoms, and toxicity is possible at levels that are too high. Furthermore, deficiency of one element may present as symptoms of toxicity from another element, and vice versa. An abundance of one nutrient may cause a deficiency of another nutrient. For example, K^+ uptake can be influenced by the amount of NH_4^+ available (Norman, 2010).

2.3.1 Nitrogen:

Nitrogen is a major constituent of several of the most important plant substances. For example, nitrogen compounds comprise 40% to 50% of the dry matter of protoplasm, and it is a constituent of amino acids, the building blocks ofproteins (Swan, 1971). It is also an essential constituent of chlorophyll. Nitrogen deficiency most often results in stunted growth, slow growth, and chlorosis. Nitrogen deficient plants will also exhibit a purple appearance on the stems, petioles and underside of leaves from an accumulation of anthocyanin pigments (Norman, 2010).Most of the nitrogen taken up by plants is from the soil in the forms of NO_3^-, although in acid environments such as boreal forests where nitrification is less likely to occur, ammonium NH_4^+ is more likely to be the dominating source of nitrogen (Lewis, 2010).Amino acids and proteins can only be built from NH_4^+, so NO_3^- must be reduced. In many agricultural settings, nitrogen is the limiting nutrient for rapid growth. Nitrogen is transported via the xylem from the roots to the leaf canopy as nitrate ions, or in an organic form, such as amino acids or amides. Nitrogen can also be transported in the phloem sap as amides, amino acids and ureides; it is therefore mobile within the plant, and the older leaves exhibit chlorosis and necrosis earlier than the younger leaves (Roy, 2006; Norman, 2010).

There is an abundant supply of nitrogen gas in the earth's atmosphere N_2 gas comprising nearly 79% of air. However, N_2 is unavailable for use by most organisms because there is a triple bond between the two nitrogen atoms, making the molecule almost inert. In order for nitrogen to be used for growth it must be "fixed" (combined) in the form of ammonium(NH_4) or nitrate (NO_3) ions. The weathering of rocks releases these ions so slowly that it has a negligible effect on the availability of fixed nitrogen. Therefore, nitrogen is often the limiting factor for growth and biomass production in all environments where there is a suitable climate and availability of water to support life (Krasowski and Owens, 1999).

Nitrogen enters the plant largely through the roots. Its composition within a species varies widely depending on several factors, including day length, time of day, night temperatures, nutrient deficiencies, and nutrient imbalance. Short day length promotes asparagine formation, whereas glutamine is produced under long day regimes. Darkness favors protein breakdown accompanied by high asparagine accumulation. Night temperature modifies the effects due to night length, and soluble nitrogen tends to accumulate owing to retarded synthesis and breakdown of proteins. Low night temperature conserves glutamine; high night temperature increases accumulation of asparagine because of breakdown of proteins. Deficiency of K accentuates differences between long- and short-day plants. The pool of soluble nitrogen is much smaller than in well-nourished plants when N and P are deficient since uptake of nitrate and further reduction and conversion of N to organic forms is restricted more than is protein synthesis. Deficiencies of Ca, K, and S affect the conversion of organic N to protein more than uptake and reduction. The size of the pool of soluble N is no guide *per se* to growth rate, but the size of the pool in relation to total N might be a useful ratio in this regard. Nitrogen availability in the rooting medium also affects the size and structure of tracheids formed in the long lateral roots of white spruce (Krasowski and Owens, 1999; Krasowski,1999).

2.3.2Phosphorus:

Like nitrogen, phosphorus is involved with many vital plant processes. Within a plant, itis present mainly as a structural component of the nucleic acids, deoxyribonucleic nucleic acid (DNA) and ribose nucleic acid (RNA), and as a constituent of fatty phospholipids, is of importance in membrane development and function. It is present in both organic and inorganic forms, both of which are readily trans-located within the plant. All energy transfers in the cell are critically dependent on phosphorus. As with all living things, phosphorus is part of the Adenosine triphosphate (ATP), which is of immediate use in all processes that require energy with the cells. Phosphorus can also be used to modify the activity of various enzymes byphosphorylation, and is used for cell signaling. Phosphorus is concentrated at the most actively growing points of a plant and stored within seeds in anticipation of their germination. Phosphorus is most commonly found in the soil in the form of polyprotic phosphoric acid (H_3PO_4), but is taken up most readily in the form of $H_2PO_4^-$. Phosphorus is available to plants in limited quantities in most soils because it is released very slowly from insoluble phosphates and is rapidly fixed once again. Under most environmental conditions it is the element that limits growth because of this constriction and due to its high demand by plants and microorganisms. Plants can increase phosphorus uptake by a mutualism with mycorrhiza (Norman, 2010).Phosphorus deficiency in plants is characterized by an intense green coloration or reddening in leaves due to lack of chlorophyll. If the plant is experiencing high phosphorus deficiencies the leaves may become denatured and show signs of death. Occasionally the leaves may appear purple from an accumulation of anthocyanin. Because phosphorus is a mobile nutrient, older leaves will show the first signs of deficiency (Black, 1957).

On some soils, the phosphorus nutrition of some conifers, including the spruces, depends on the ability of mycorrhizae to take up, and make soil phosphorus available to the tree, hitherto unobtainable to the non-mycorrhizal root. Seedling of white spruce, greenhouse-grown in sand tested negative for phosphorus, were very small and purple for many months until spontaneous mycorrhizal inoculation.The effect of which was manifested by a greening of foliage and the vigorous shoot growth (Black,1957).

Phosphorus deficiency can produce symptoms similar to those of nitrogen deficiency,(Black, 1957) but as noted by Russell,(1961): “Phosphate deficiency differs from nitrogen deficiency in being extremely difficult to diagnose, and crops can be suffering from extreme starvation without there being any obvious signs that lack of phosphate is the cause”. Russell’s observation applies to at least some coniferous seedlings, but Benzian, (1965) found that although response to phosphorus in very acid forest tree nurseries in England was consistently high, no species (including Sitka spruce) showed any visible symptom of deficiency other than a slight lack of 10uster. Phosphorus levels have to be exceedingly low before visible symptoms appear in such seedlings. In sand culture at 0 ppm phosphorus, white spruce seedlings were very small and tinted deep purple; at 0.62 ppm, only the smallest seedlings were deep purple; at 6.2 ppm, the seedlings were of good size and color (Swan, 1960; 1962)

It is useful to apply a high phosphorus content fertilizer, such as bone meal, to perennials to help with successful root formation (Norman, 2010).

2.3.3 Potassium:

Unlike other major elements, potassium does not enter into the composition of any of the important plant constituents involved in metabolism (Swan, 1971) but it does occur in all parts of plants in substantial amounts. It seems to be of particular importance in leaves and at growing points. Potassium is outstanding among the nutrient elements for its mobility and solubility within plant tissues. Processes involving potassium include the formation of carbohydrates and proteins, the regulation of internal plant moisture, as a catalyst and condensing agent of complex substances, as an accelerator of enzyme action, and as contributor to photosynthesis, especially under low light intensity (Heibeg, 1951).

When soil-potassium levels are high, plants take up more potassium than needed for healthy growth. The term *luxury consumption* has been applied to this. When potassium is moderately deficient, the effects first appear in the older tissues, and from there progress towards the growing points. Acute deficiency severely affects growing points, and die-back commonly occurs. Symptoms of potassium deficiency in white spruce include: browning and death of needles (chlorosis); reduced growth in height and diameter; impaired retention of needles; and reduced needle length (Heiberg, 1951). A relationship between potassium nutrition and cold resistance has been found in several tree species, including 2 species of spruce (Sato, 1951).

Potassium regulates the opening and closing of the stomata by a potassium ion pump. Since stomata are important in water regulation, potassium reduces water loss from the leaves and increases drought tolerance. Potassium deficiencymay cause necrosis or interveinalchlorosis. K^+ is highly mobile and can aid in balancing the anion charges within the plant. Potassium helps in fruit coloration, shape and also increases its Brix. Hence, quality fruits are produced in potassium-rich soils. Potassium serves as an activator of enzymes used in photosynthesis and respiration. Potassium is used to build cellulose and aids in photosynthesis by the formation of a chlorophyll precursor. Potassium deficiency may result in higher risk of pathogens, wilting, chlorosis, brown spotting, and higher chances of damage from frost and heat (Norman, 2010).

2.3.4 The secondary macronutrients

2.3.4.1 Sulfur:

Sulfur is a structural component of some amino acids and vitamins, and is essential in the manufacturing of chloroplasts. Sulfur is also found in the iron-sulfur complexes of the electron transport chains in photosynthesis. It is immobile and deficiency, therefore, affects younger tissues first. Symptoms of deficiency include yellowing of leaves and stunted growth (Silva and Uchida, 2000).

2.3.4.2 Calcium:

Calcium regulates transport of other nutrients into the plant and is also involved in the activation of certain plant enzymes (Arizona, 2012).Calcium deficiency results in stunting. This nutrient is involved in photosynthesis and plant structure. Blossom end rotis also a result of inadequate calcium.

Calcium in plants occurs chiefly in the leaves, with lower concentrations in seeds, fruits, and roots. A major function is as a constituent of cell walls. When coupled with certain acidic compounds of the jelly-like pectins of the middle lamella, calcium forms an insoluble salt. It is also intimately involved in meristems, and is particularly important in root development, with roles in cell division, cell elongation, and the detoxification of hydrogen ions. Other functions attributed to calcium are; the neutralization of organic acids; inhibition of some potassium-activated ions; and a role in nitrogen absorption. A notable feature of calcium-deficient plants is a defective root system (Russell, 1961). Roots are usually affected before above-ground parts (Chapman,1966).

2.3.4.3 Magnesium:

The outstanding role of magnesium in plant nutrition is as a constituent of the chlorophyll molecule. As a carrier, it is also involved in numerous enzyme reactions as an effective activator, in which it is closely associated with energy-supplyingphosphorus compounds. Magnesium is very mobile in plants, and, like potassium, when deficient is trans-located from older to younger tissues, so that signs of deficiency appear first on the oldest tissues and then spread progressively to younger tissues (Silva and Unchida, 2000).

2.3.5 Micro-nutrients:

Some elements are directly involved in plant metabolism (Arnon and Stout, 1939). However, this principle does not account for the so-called beneficial elements, whose presence, while not required, has clear positive effects on plant growth. Mineral elements that stimulated growth but are not essential, or that are essential only for certain plant species, or under given conditions, are usually defined as beneficial elements (Arnon and Shot. 1939).

Plants are able to accumulate most trace elements. Some plants are sensitive indicators of the chemical environment in which they grow (Dunn 1991),and some plants have barrier mechanisms that exclude or limit the uptake of a particular element or ion form, e.g., alder twigs commonly accumulate molybdenum but not arsenic, whereas the reverse is true of spruce bark (Dunn, 1991). Otherwise, a plant can integrate the geochemical signature of the soil mass permeated by its root system together with the contained groundwaters. Sampling is facilitated by the tendency of many elements to accumulate in tissues at the plant's extremities (Dunn, 1991).

2.3.5.1 Iron:

Iron is necessary for photosynthesis and is present as an enzyme cofactor in plants. Iron deficiency can result in interveinalchlorosis and necrosis. Iron is not a structural part of chlorophyll but very much essential for its synthesis. Copper deficiency can be responsible for promoting an iron deficiency(Ruhr, 2012).

2.3.5.2 Molybdenum:

Molybdenum is a cofactor to enzymes important in building amino acids and is involved in nitrogen metabolism. Molybdenum is part of the nitrate reductase enzyme (needed for the reduction of nitrate) and the nitrogenase enzyme (required for biological nitrogen fixation). (Roy, 2006).

2.3.5.3 Boron:

Boron is found in the highly insoluble mineral, tourmaline. It is absorbed by plants in the form of the anion BO_3^{3-}. It is available to plants in moderately soluble mineral forms of Ca, Mg and Na borates and the highly soluble form of organic compounds. Concentration in soil must, in general, be below 5 ppm in the soil water solution, above that toxicity results. Its availability in soils ranges from 3.7 to 37.3kilogram per hectare in the first eight inches, of which less than 5% is available. It is available to plants over a range of pH, from 5.0 to 7.5. It is mobile in the soil hence, it is prone to leaching. Leaching removes substantial amounts of boron in sandy soil, but little in fine silt or clay soil. Boron's fixation to those minerals at high pH can render boron unavailable, while low pH frees the fixed boron, leaving it prone to leaching in wet climates. It precipitates with other minerals in the form of borax in which form it was first used over 400 years ago as a soil supplement. Decomposition of organic material causes boron to be deposited in the topmost soil layer; organic forms of boron are more soluble than their mineral form, hence are more available in the top few inches. When soil dries it can cause a precipitous drop in the availability of boron to plants as the plants cannot draw nutrients from that desiccated layer. Hence, boron deficiency symptoms appear in dry weather (Brown*et.al*.,2002).

Boron has many functions within a plant: it affects flowering and fruiting, pollen germination, cell division, and active salt absorption. The metabolism of amino acids and proteins, carbohydrates, calcium, and water are strongly affected by boron. Many of those listed functions may be embodied by its function in moving the highly polar sugars through cell membranes by reducing their polarity and hence the energy needed to pass the sugar. If sugar cannot pass to the fastest growing parts rapidly enough, those parts die. Boron is relatively immobile within a plant suggesting that the molecule is fixed to the points in the membrane where they facilitate sugar transport (Brown*et.al*.,2002).

Boron is not relocatable in the plant via the phloem. It must be supplied to the growing parts via the xylem. Foliar sprays affect only those parts sprayed, which may be insufficient for the fastest growing parts, and is very temporary (Brown, *et.al*.,2002).

Boron is essential for the proper forming and strengthening of cell walls. Lack of boron results in short thick cells producing stunted fruiting bodies and roots. Calcium to boron ratio must be maintained in a narrow range for normal plant growth. For alfalfa, that calcium to boron ratio must be from 80:1 to 600:1. Boron deficiency appears at 800:1 and higher. For alfalfa, similar ratios exist for magnesium, copper, nitrogen and potassium. Boron levels within plants differ with plant species and range from 2.3 ppm for barley to 94.7 ppm for poppy. Lack of boron causes failure of calcium metabolism which produces hollow heart in beets and peanuts (Shorrocks, 1997).

Inadequate amounts of boron affect many agricultural crops, legume forage crops most strongly. Of the micronutrients, boron deficiencies are second most common after zinc. Deficiencies of boron when soil is cropped are common and require the application of mineral supplement; one ton of alfalfa hay carries with it one ounce of boron, 100 bushels of peaches 4 ounces. Deficiency results in the death of the terminal growing points. Symptoms first appear as stunted growth, then to cellular changes, which leads to physical changes, and finally death of the plant (Brown, *et.all.*,2002).

Boron supplements derive from dry lake bed deposits such as those in Death Valley, USA, in the form of sodium tetraborate, from which less soluble calcium borate is made. Foliar sprays are used on fruit crop trees in soils of high alkalinity. Boron is often applied to fields as a contaminant in other soil amendments but is not generally adequate to make up the rate of loss by cropping. The rates of application of borate to produce an adequate alfalfa crop range from 15 pounds per acre for a sandy-silt, acidic soil of low organic matter, to 60 pounds per acre for a soil with high organic matter, high cation exchange capacity and high pH.

Boron concentration in soil water solution higher than one ppm is toxic to most plants. Toxic concentrations within plants are 10 to 50 ppm for small grains and 200 ppm in boron-tolerant crops such as sugar beets, rutabaga, cucumbers, and conifers. Toxic soil conditions are generally limited to arid regions or can be caused by underground borax deposits in contact with water or volcanic gases dissolved in percolating water. Application rates should be limited to a few pounds per acre in a test plot to determine if boron is needed generally. Otherwise, testing for boron levels in plant material is required to determine remedies. Excess boron can be removed by irrigation and assisted by application of elemental sulfur to lower the pH and increase boron's solubility. Application of calcium will increase soil alkalinity, causing boron to fix on the mineral soil component and remove some fraction, thereby reducing boron toxicity(Eaton, 2016).

Boron deficiencies must be detected by analysis of plant material to apply a correction before the obvious symptoms appear, after which it is too late to prevent crop loss. Strawberries deficient in boron will produce lumpy fruit; apricots will not blossom or, if they do, will not fruit or will drop their fruit depending on the level of boron deficit. Broadcast of boron supplements is effective and long term; a foliar spray is immediate but must be repeated (Cakmak,1997).

2.3.5.4 Copper:

Copper is important for photosynthesis. Symptoms for copper deficiency include chlorosis.It is involved in many enzyme processes; necessary for proper photosynthesis; involved in the manufacture of lignin (cell walls) and involved in grain production. It is also hard to find in some soil conditions (Silva and Unchida, 2000).

2.3.5.5 Manganese:

Manganese is necessary for photosynthesisincluding the building of chloroplasts. Manganese deficiency may result in coloration abnormalities, such as discolored spots on the foliage(Arizona, 2012).

2.3.5.6 Sodium:

Sodium is involved in the regeneration of phosphoenolpyruvate in CAM and C4 plants. Sodium can potentially replace potassium's regulation of stomatal opening and closing (Norman, 2010). It is essential for C4 plants rather than C3**,** stimulates the growth of plants through increasing leaf area and improving the water balanceand crop quality e.g. improves the taste of carrots by increasing sucrose (Norman, 2010)**.**

2.3.5.7 Zinc:

Zinc is required in a large number of enzymes and plays an essential role in DNA transcription. A typical symptom of zinc deficiency is the stunted growth of leaves, commonly known as "little leaf" and is caused by the oxidative degradation of the growth hormone auxin (Silva and Unchida, 2000).

2.3.5.8 Nickel:

In higher plants, nickel is absorbed by plants in the form of Ni^{2+} ion. Nickel is essential for activation of urease, an enzyme involved with nitrogen metabolism that is required to process urea. Without nickel, toxic levels of urea accumulate, leading to the formation of necrotic lesions. In lower plants, nickel activates several enzymes involved in a variety of processes, and can substitute for zinc and iron as a cofactor in some enzymes (Barker, 2007).

2.3.5.9 Chlorine:

Chlorine, as compounded chloride, is necessary for osmosis and ionic balance; it also plays a role in photosynthesis(Silva and Unchida, 2000).

2.3.5.10 Cobalt:

Cobalt has proven to be beneficial to at least some plants although it does not appear to be essential for most species. It has, however, been shown to be essential for nitrogen fixation by the nitrogen-fixing bacteria associated with legumes and other plants (Barker, 2015).

2.3.5.11 Aluminium:

Some plants have a high tolerance for aluminum (Al) toxicity and the growth is stimulated by Al application. The possible reason is the prevention of Cu, Mn or P toxicity effects.There have been reports that Al may serve as a fungicide against certain types of root rot.

2.3.5.12 Silicon:

Silicon is not considered an essential element for plant growth and development. It is always found in abundance in the environment and hence if needed it is available. It is found in the structures of plants and improves the health of plants.It has been shown in experiments to strengthen cell walls, improve plant strength, health, and productivity.There have been studies showing evidence of silicon improving drought and frost resistance, decreasing lodging potential and boosting the plant's natural pest and disease fighting systems. (Prakash, 2007). Silicon has also been shown to improve plant vigor and physiology by improving root mass and density, and increasing above ground plant biomass and crop yields. Silicon is currently under consideration by the Association of American Plant Food Control Officials (AAPFCO) for elevation to the status of a "plant beneficial substance"(Miranda, 2009).

2.3.5.13 Vanadium:

Vanadium may be required by some plants, but at very low concentrations. It may also be substituting for molybdenum (Roy, 2006).

2.3.5.14 Selenium:

Selenium is probably not essential for flowering plants, but it can be beneficial; it can stimulate plant growth, improve tolerance of oxidative stress, and increase resistance to pathogens and herbivory (White and Philip, 2010).It is, however, an essential mineral element for animal (including human) nutrition and selenium deficiencies are known to occur when food or animal feed is grown on selenium-deficient soils. It is important for fertilization of edible crops and animal diets thereby improving their health (White and Philip, 2010).

2.4Organic Fertilizers:

Organic fertilizers are fertilizers derived from animal matter, human excreta or vegetable matter for e.g. compost, manure. Naturally occurring organic fertilizers include animal wastes from meat processing peat, manure, slurry and guano. The main sources of organic fertilizers are peat, animal wastes plants waste from agriculture and treated sewage sludge (Dittmar, 2009). Peat is an immature precursor of coal. Peat itself offers no nutritional value to the plants, but improves the soil by aeration and absorbing water (Fao,2015).

An organic fertilizer is a source of raw material in the form of wastes of households, restaurants, markets, farms and other types of wastes. The organic waste can be made into compost or solid fertilizers or, can be also made in the form of liquid fertilizer (Nasaruddin and Rosmawati, 2011).The liquid organic fertilizer is made from animal manure composted, natural waste, plant hormones and other natural organicmaterials. The benefits of liquid organic fertilizer include provision of nutrients for the growing plants; improve soil structure, andrepress harmful bacteria in the soil. The continuous use of liquid fertilizers will improve the physical, chemical and biological properties of the soil, and is safe for the environment. The application of liquid organic fertilizers through the leaf spray or soil application as drench can increase the growth and yield of plants (Rukman, 1993).

Organic fertilizers are important for both, plant growth and development and the soil. They help in improving plant productivity and product quality, improve the physical and chemicalcharacteristics of the soils, and are safe for human, animal and the environment (Samah, 2002).

Tsvetkov,(2014) evaluated the effect of some organic substrates on the growth and first yield of a local Bulgarian red wine grape variety “Mavrud” and found no difference between plants cultivated by conventional agricultural methods and those cultivated by organic agriculture in all measured parameters. The planting material is of high quality at the second year of growth and yield.

2.5Bio- Fertilizers:

A Bio fertilizer is a substance which contains living microorganismswhen applied to seed, plant surface or soil.It colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant (Vessey, 2003). Bio fertilizers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphates and stimulating plant growth through the synthesis of growth promoting substances. Bio-fertilizers can be expected to reduce the use of chemical fertilizers and pesticides. The microorganisms in bio fertilizers restore the soil natural nutrients cycle and build soil organic matter. Through the use of bio-fertilizers, healthy plants can be grown, while enhancing the sustainability and the health of the soil. They are extremely advantageous in enriching soil fertility and fulfilling plant nutrient requirements by supplying the organic nutrients through micro organisms and their by-products. Hence bio fertilizers do not contain any chemicals which are harmful to the living soil. Bio fertilizers provide eco-friendly organic agro-input.Bio- fertilizers such as Rhizobium,Azotobacter, Azospirilum and blue green alge have been in use long time as bio-fertilizers around the world (Vessey, 2003).

Microorganisms have a central role in almost all aspects of nitrogen availability, and therefore for life support on earth. Some bacteria can convert N_2 into ammonia by the process termed *Nitrogen Fixation*; these bacteria are either free-living or form symbiotic associations with plants or other organisms (e.g., termites, protozoa), while other bacteria bring about transformations of ammonia to nitrate, and of nitrate to N_2 or other nitrogen gases. Many bacteria and fungi degrade organic matter, releasing fixed nitrogen for reuse by other organisms. All these processes contribute to the nitrogen cycle (Krasowski, 1991).

Bybordy, (2012)studied the effect of salinity on some physiological and morphological properties of two grape cultivars and observed that salinity levels affect chlorophyll formationand transpiration rate resulting in decrease in plant height, leaf area, dry weight of stem, prolineand chlorophyll content, rates of photosynthesis and transpiration, stomatal conductance, dry and fresh weights of stem and root and nitrogen and sodium content of leaf. Similar results were reported by (Hatami*et al.*, 2010) in their study on the effect of salinity on some gas exchange characteristics of some cultivars of grape.Mohammed Khani, *et al.*, (2016) obtained significant differences between tolerant and sensitive genotypes grape in their study on the effect of salinity on some gas exchange characteristics of grape cultivars.Ali, *et al.*, (2013) examined the effect of humic acid and commercial bio-fertilizer trade named “Uni-sal” on grapevine growth and yield and found that application of humic acid and “Uni-sal” were more effective in reducing salinity of soil and improving growth, yield and berry quality characteristics.

CHAPTER THREE

MATERIALSandMETHODS

3.1. Experimental Site.

Experiments were conducted during the winter season of theyear 2015 in the nurseries ofZadna Company for Agricultural Services,Al-Kadaro, Khartoum North, (Latitude 15̊ 44̓ 39̋ N , Longitude 32̊ 35̓ 52̋ E). Seven years oldgrape trees of the cultivars ″Cardinal” and “Crimson″ were visually selectedon the basis of size to minimize potential tree size effects. The trees were planted in holes in a loamy clay soil at spacing of 2×3 m. Drip irrigation is used for irrigation purposes andwater was applied once every 7 days during summer and every 10 to 15 days during autumn and winter.

3.1.1 Bio-activator:

TheBio-activator Elixir was supplied by the Bio Activator Factory for Agricultural Fertilizers, Khartoum North (Appendix 1).

3.1.2 Cultivars

Crimson”and “Cardinal” grape cultivars were used throughout this study.

3.1.3 Experimental design

Randomized block design with four treatments and three replicates was used. The treatments testedare:

1/ 0ml/plant Elixir

2/ 4ml/plant Elixir

3/ 12ml/plant Elixir

4/20ml/plant Elixir

Treatments are added on doses, some plants were added the Elixir once (4ml/plant), three times (12ml/plant) and five time (20ml/plant).

3.2. Data collection

3.2.1. Growth parameters:

Three plants per block were selected randomly for data collection every week. The mean of the three plants was calculated.

3.2.1.1. Vegetative Characteristics:

3.2.1.1.1. Number of leaves per plant

Number of leaves of randomly selected plants, each of the plant sampled was counted and the mean number of leaves per plant was recorded.

3.2.1.1.2.Leaf area (cm) per plant

The leaf area of the same plant of the plant sampled was counted and the mean leaf area per plant was calculated.

3.2.1.1.3.Number of branches per plant

Number of branches on the same plant of the plant sampled was counted and mean number of branches per plant was obtained

3.2.1.1.4.Number of inflorescence per plant

Number of inflorescence of the same plant of the plant sampled was counted and mean number of inflorescence per plant was obtained

3.2.1.1.5.Length of inflorescence (cm) per plant

Length of inflorescence of the same plantof the plant sampled was measured and mean length of inflorescence per plant was recorded.

3.2.1.2. Yield and yield components:

3.2.1.2.1. Total Yield

The clusters of the same plant each tree were harvested after ripening and the following parameters were calculated:

1/Number of clusters

2/Length of cluster (cm)

3/Number of berries or fruits per cluster

4/Weight of clusters (g)

5/Yield (ton per hectare)

3.2.1.3. Fruits or berries quality:

Three berries were selected randomly from each clusters to determine the following parameters:

1/Berry or fruit weight (g)

2/Diameter of berry or fruit (mm)

3/Berry total soluble solids (TSS): was measured by a Refractometer (0-32%).

3.2.2. Soil Analysis.

Soil samples were taken before and after adding the fertilizer to determine soil pH and EC (Table5)

3.3 Statistical Analysis:

Data were statistically analyzed by analysis of variance (ANOVA) on Excel computer programmer. Duncan's multiple range test was used to separate treatments means at P=0.05 level of significance.

CHAPTER FOUR

RESULTSAND DISCUTION

4.1. Effect of Elixir on vegetative characters

4.1.1. Number of leaves per plant

The effect of Elixir treatments on number of leaves of “Cardinal”, and “Crimson”,grape cultivars showed significant differences between treatments and the control. Thetreatment 12ml/plant Elixir gave the greatest number of leaves, followed by the 20ml/plant Elixir, the control, and the 4ml/plant Elixir treatment in thevariety “Cardinal” Fig (1.a). On the other hand, The 20ml/plant treatment recorded significantly high number of leaves, followed by the control, the 12ml/plant Elixir,and the 4ml/plant Elixir treatments in the variety “Crimson” Fig (1.b)**.**

The increase in number of leaves per plant after applying elixir treatments may be due to enhancement of mineral transformation to the available form to the plant by the action of bacteria and additional minerals content of the plant.

Nutrients play an important role in the synthesis of many organic compounds of the plant, which is working to increase the growth and elongation of plant .This results agreed with Shaheen (2013) who indicated the increase in vegetative growth when he used bio fertilizer.

4.1.2. Leaf area (cm) per plant

The effect of the Elixir treatments on leaf area of “Cardinal”, and “Crimson” grape cultivars revealed significant differences between treatments and the control. The 20 ml/plant Elixir treatment recorded

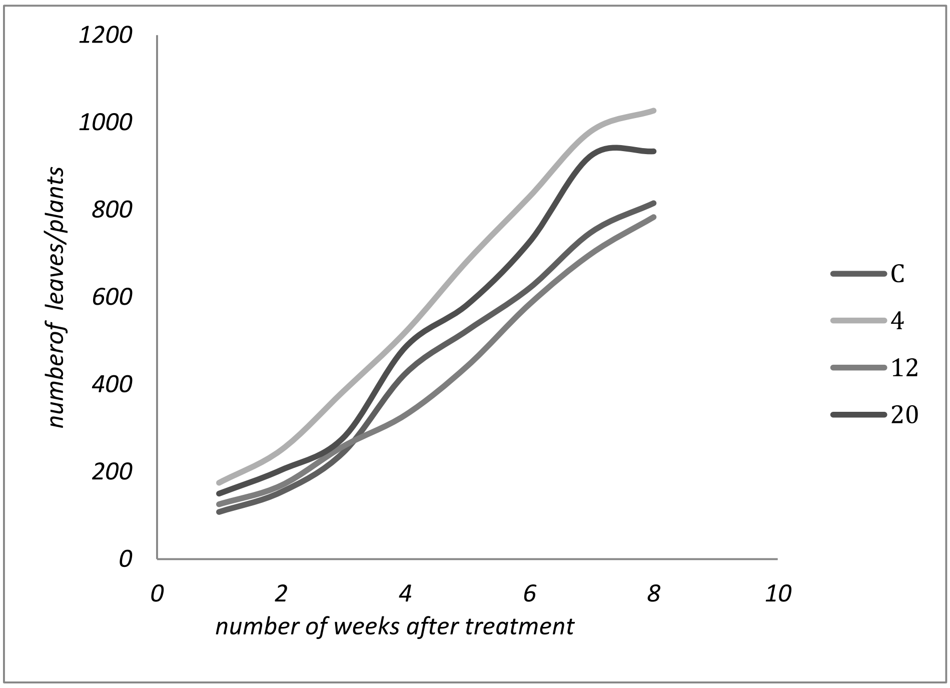

Fig (1.a): Effects of Elixir doses on number of leavesof grape variety cardinal.

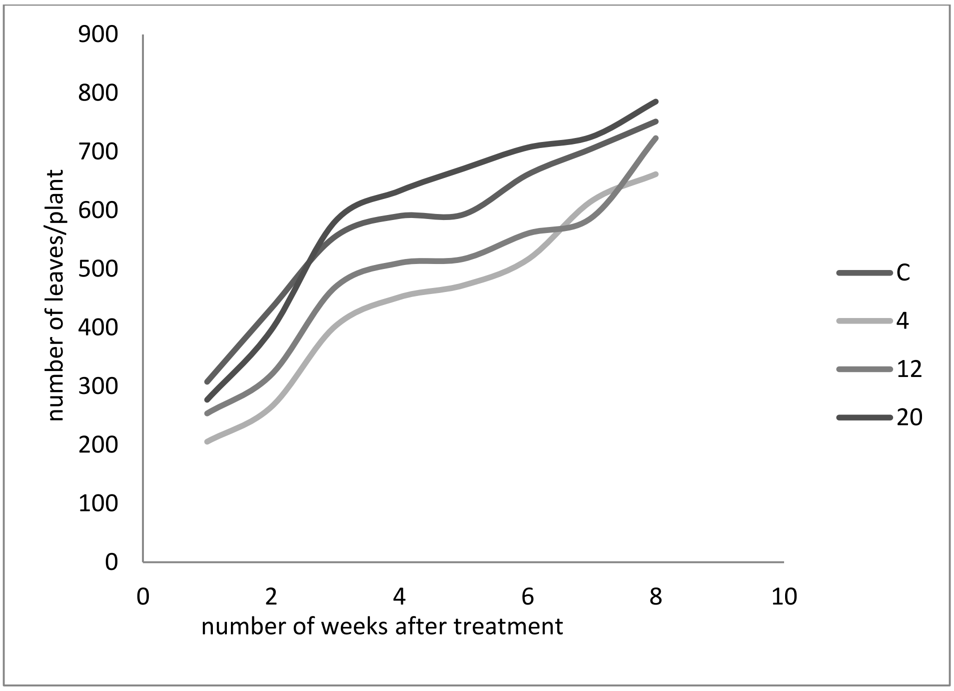

Fig (1.b): Effects of Elixir doses on number of leaves of grape varietyCrimson.

Thehighest leaf area value followed by the 12ml/plant Elixir treatment, the4ml/plant Elixir,and the control in the variety “Cardinal” Fig (2.a). The response of the variety “Crimson” to Elixir treatments followed the same trend as the response of the variety “Cardinal” with the 20ml/plant Elixir treatment recording the highest leaf area value followed by the 12ml/plant, 4ml/plant, and the control. in variety Fig (2.b) .

Nutrient content in the Elixir it increase leaf area, it play important role in metabolic process, Inducts in the synthesis of chlorophyll, which is necessary for photosynthesis and release of energy provided by Elixir. It also works to facilitate of the availability of soil elements, specially these construing plants which obtain 20ml/plant and 12ml/plant from Elixir be better than that obtained 4ml/plant and zero. This result agreed with Abd Ella (2006). Who found the bio fertilizer there of significantly increase the vegetative growth.

.4.1.3. Number of branches per plant.

The effect of the Elixir treatments on number of branches of the grape varieties Cardinal and “Crimson” displayed in Fig 3 showed differences between the two grape varieties in response to Elixir treatments. “Cardinal” gave the highest number of branches with the 4ml/plant Elixir treatment followed by the20 ml/plant, 12ml/plant and the control whereas Fig (3.a), “Crimson” recorded the greatest number of branches with the 20ml/plant followed by the, control, 12ml/plant, and 4ml/plant treatments Fig (3.b).

After applying Elixir treatments plants take nutrients from it , and the mineral be available to absorption and this resulted in increase number

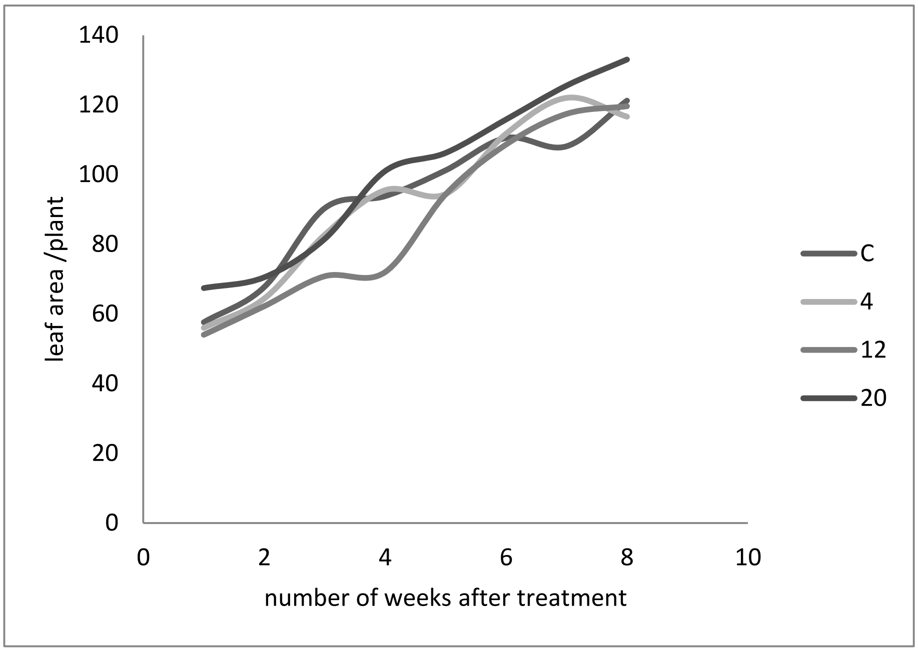

Fig (2.a): Effect of Elixir doses on leaf area of two grape variety Cardinal

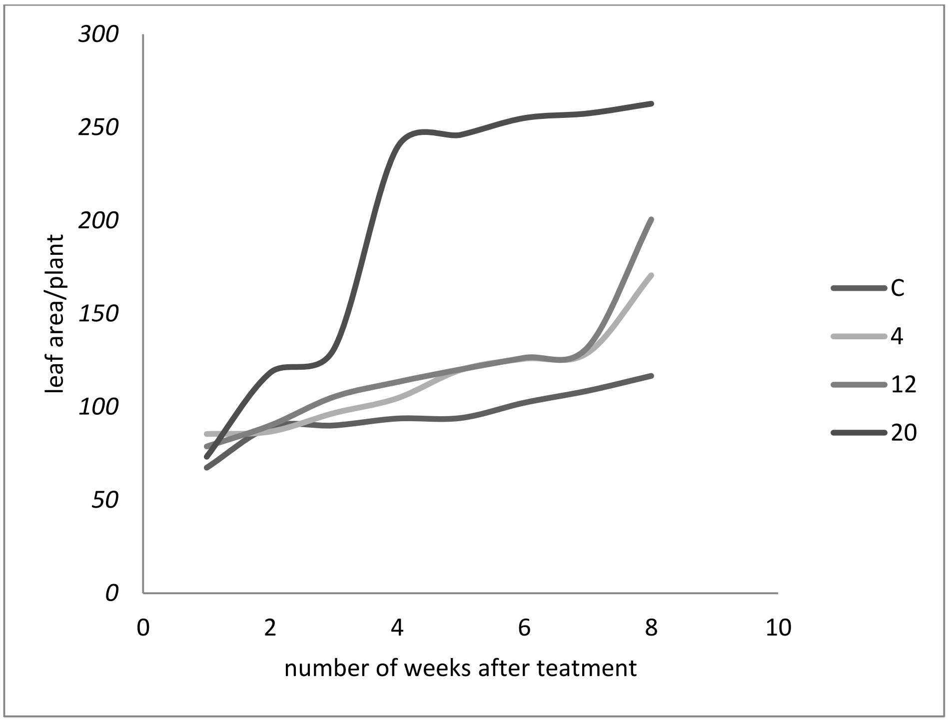

Fig (2.b): Effect of Elixir doses on leaf area of grape variety Crimson.

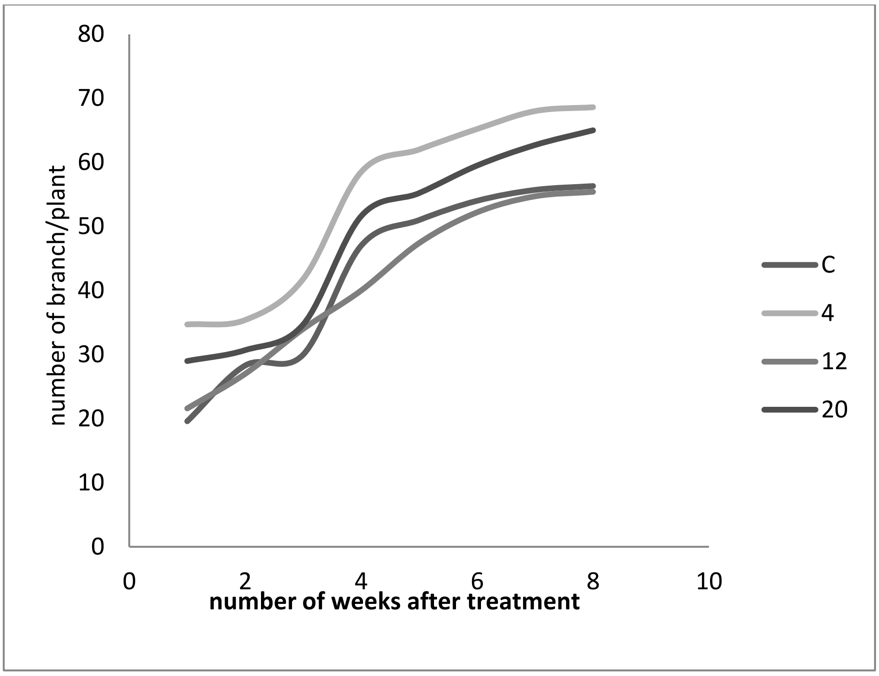

Fig (3.a): Effect of Elixir doses on number of branches of grape variety Cardinal

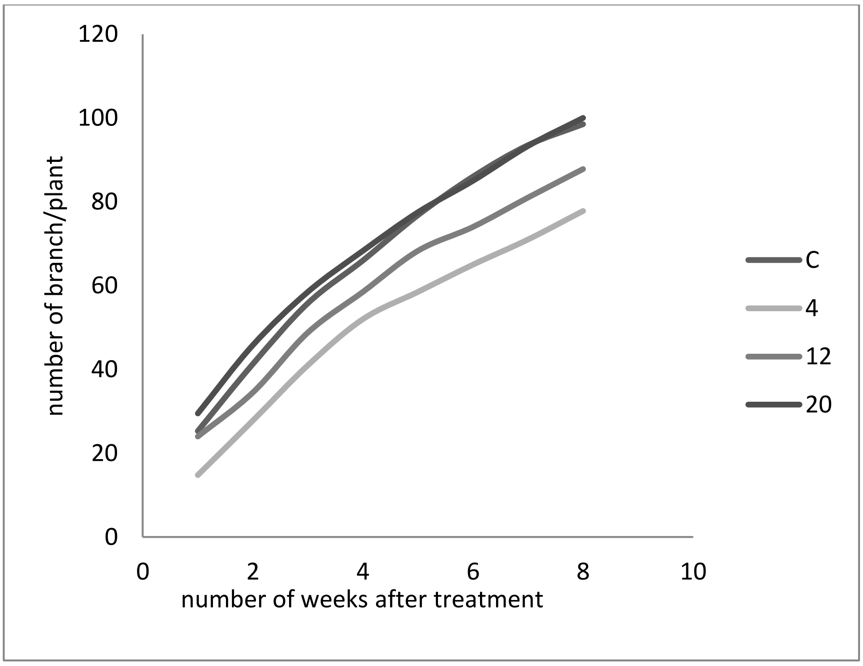

Fig (3.b): Effect of Elixir doses on number of branches of grape variety Crimson.

of branches per plant . This result agreed by Shaheen (2013) who found significant increase in number of branch.

4.1.4. Number of inflorescence per plant

Fig.4. shows the effect of Elixir treatments on number of inflorescences of the grape variety “Cardinal” and” “Crimson”. The two grape varieties responded differently to Elixir tratments tested. “Cardinal” gave the greatest number of inflorescences with the 4ml/plant Elixir followed by the 20ml/plant, 12ml/plant and finally the control treatments Fig (4.a). The 20ml/plant Elixir treatment recorded the highest number of inflorescenceswith “Crimson” followed by the control, 12ml/plant and then the 4ml/plant treatment Fig (4.b).

Availability of nutrient by bacteria and some nutrient in Elixir resulted in increase the number of inflorescences per plant, Elixir contains the necessary nutrients biological processes within the plant that stimulate the growth of bed flowering, pollination, fertilization process and improved fruit sitting, this interpreted the plants that added 20ml/plant Elixir and 12ml/plant Elixirwas produced number of inflorescence more than 4ml/plant Elixir and zero treatment. This result agreed with Ali, *et.al.*,(2013) when used bio fertilizer on grapevine were more effective in improving growth .

4.1.5. Length of inflorescence (cm) per plant

As shown in Fig. 5(a, b).The two grape varieties showed differences in response to Elixir treatments with regard to length of inflorescence.“Cardinal” the 20ml/plant Elixir and 12ml/plant Elixir treatment recorded high values of length of inflorescences followed by

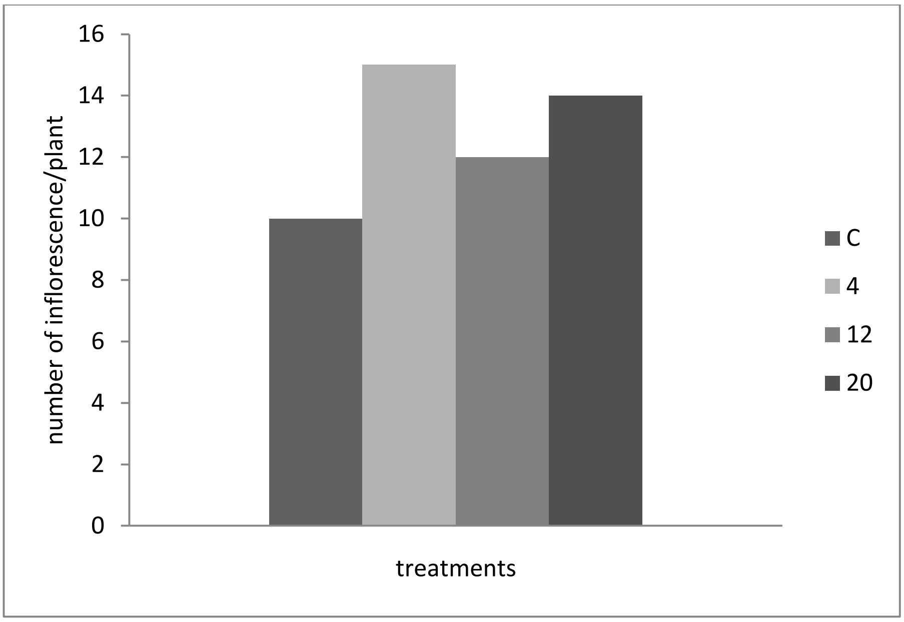

Fig (4.a): Effect of Elixir doses on number of inflorescence of grape variety Cardinal.

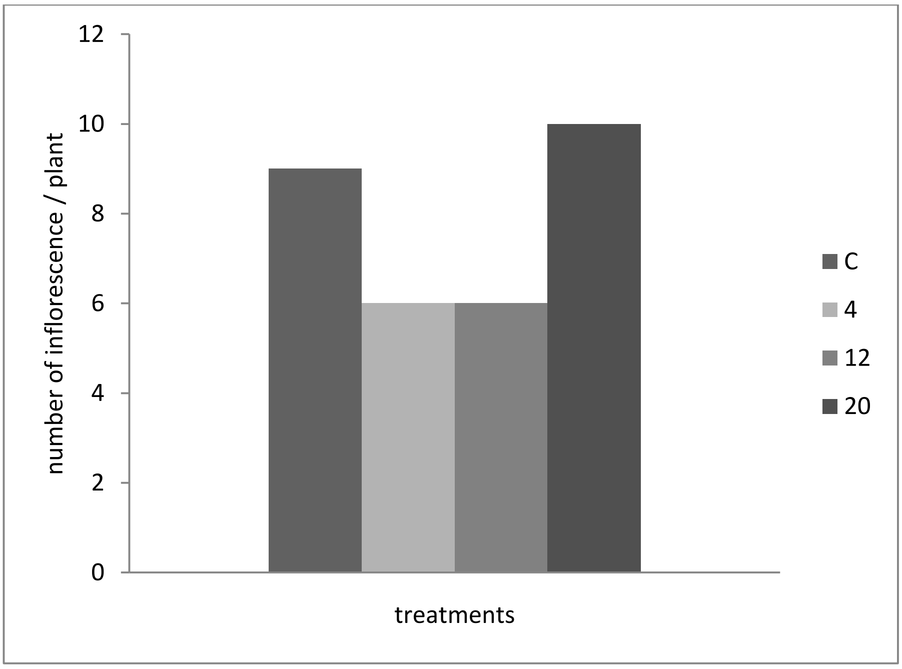

Fig (4.b): Effect of Elixir doses on number of inflorescence of grape variety Crimson.

the 4ml/plant Elixir and the zero treatmentFig (5.a). The 20ml/plant Elixir treatment gave the longest inflorescences followed by the 12ml/plant Elixir, the 4ml/plant Elixir and the control in the grape variety “Crimson”Fig (5.b).

That positive effect might be attributes the enhanced availability by Elixir for biological processes within the plant that stimulate the growth of flower bud, pollination , fertilization process and improved fruit setting .It also works on the availability of soil elements and balance .This result agreed with those Ali , *et. al.*,(2013) who found the used of bio fertilizers improve growth , yield and quality parameters.

4.2. Effect of Elixir on Yield

4.2.1.Total yield

Data analysis showed significant differences in yield between treatments in the two grape varieties.” Crimson” recorded the highest yield with the 12ml/plant Elixir treatment while the least yield was obtained with the 4ml/plant Elixir treatment. The variety” Cardinal” recorded the highest yield with the 20ml/plant Elixir treatment and the least yield with the control(Table 4).

Total yield was affected by adding Elixir treatments according to amount of fertilizer adding .The degree of balance of nutrients when optimize the balance of plant works to increase plant productivity Where nutrients provide works to raise the efficiency of physiological processes within the plant. This result agreed with Derkowska, *et .al.*, (2015) how found increased the grow in strawberry plants when he used biofertilizers.

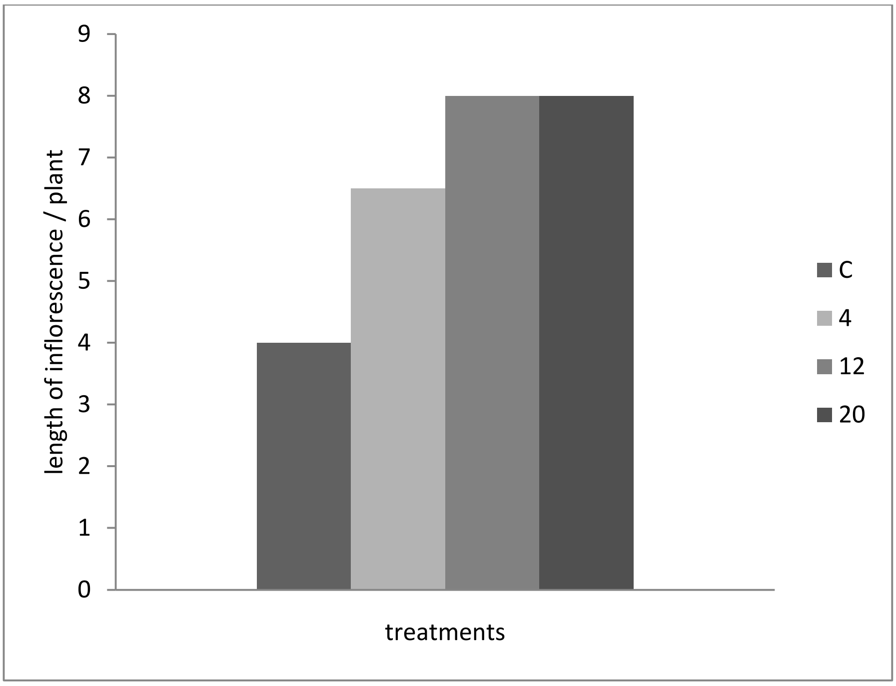

Fig (5.a): Effect of Elixir on length of inflorescence of grape variety Cardinal.

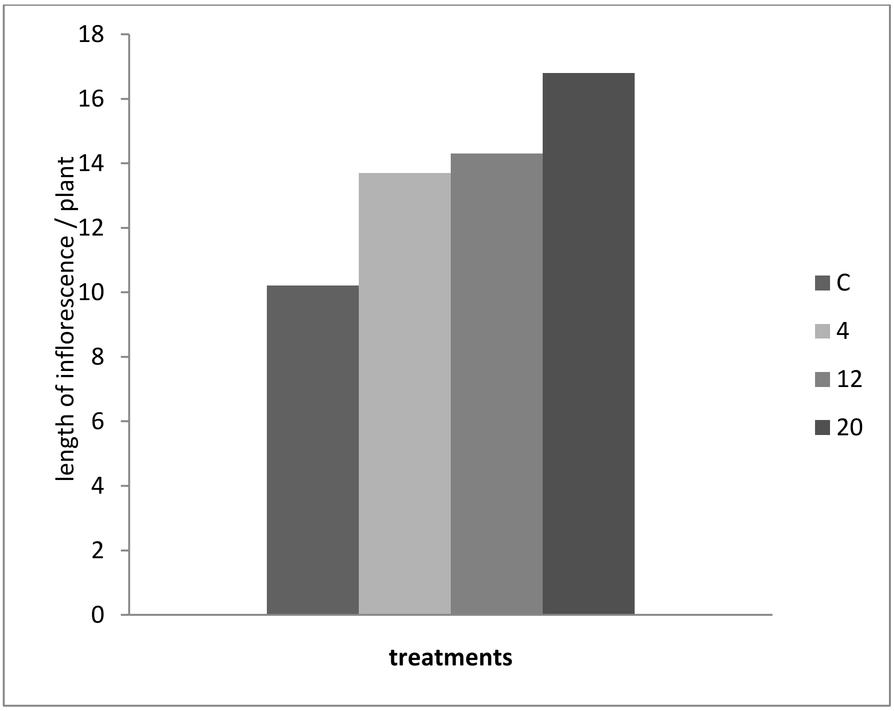

Fig (5.b): Effect of Elixir on length of inflorescence of grape variety Crimson.

4.2.2. Number of cluster

The results of the effect of the Elixir treatments on number of clusters of the grape varieties ”Cardinal” , and “Crimson” is depicted in Fig.6. Differences among treatments and between cultivar are evident. The 20ml/plant Elixir treatment gave the highest number of clusters in “Cardinal” followed by the 12ml/plant, control, and the 4ml/plant treatmentsFig (6.a). “Crimson” variety followed the same trend in response to Elixir treatmentsFig (6.b).

This variation in number of clusters per plant resulted from availability of nutrient after adding Elixir treatments. It must be the presence of different elements in the soil condition and in sufficient quantities balanced and soft metal to complete the plant needs for better growth and productivity of the plant and that’s provided by the bio-activator Elixir. This result agreed with Ali, *et. al*., (2013) who found that the addition of bio fertilizers improved growth , yield and quality parameters.

4.2.3. Cluster length

The results of the effect of Elixir treatments on length of clusters of the grape variety “Cardinal” revealed that the longest clusters were obtained with the 20ml/plant Elixirtreatment followed by the 12ml/plant, 4ml/plant and the control treatment. The response of the grape variety” Cardinal” to the application of Elixir treatments followed the same as that of “Crimson” (Fig 7.a, b). Nutrients in fertilizers play important roles in vine growth, yield and quality. These elements work together to raise metabolism process, which in turn increases the productivity of the plant.

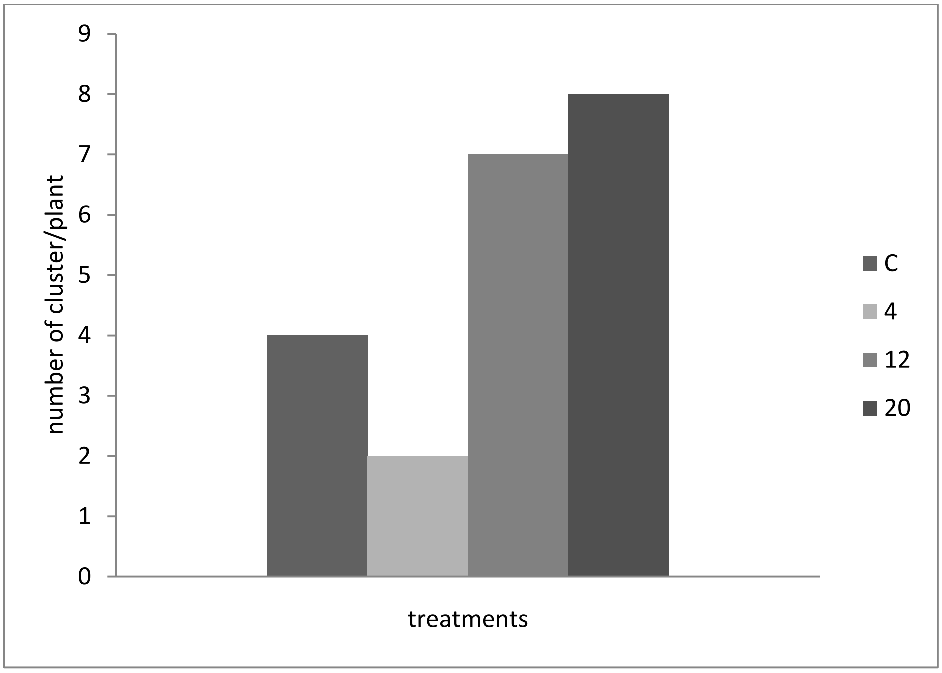

Fig (6.a): Effect of Elixir doses on number of clusters of grape variety Cardinal.

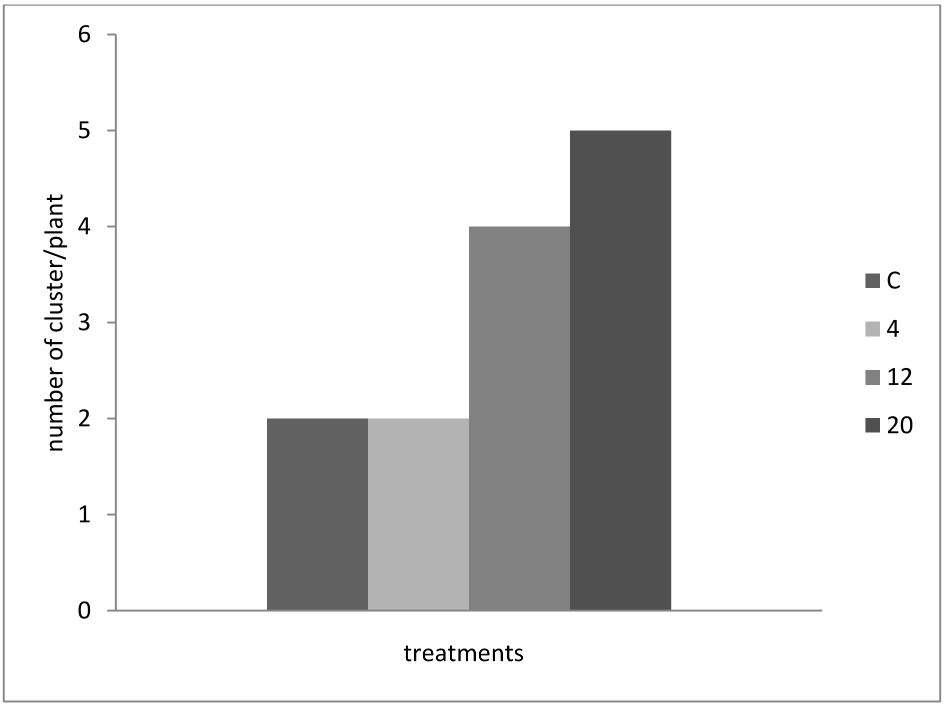

Fig (6.b): Effect of Elixir doses on number of clusters of grape variety crimson.

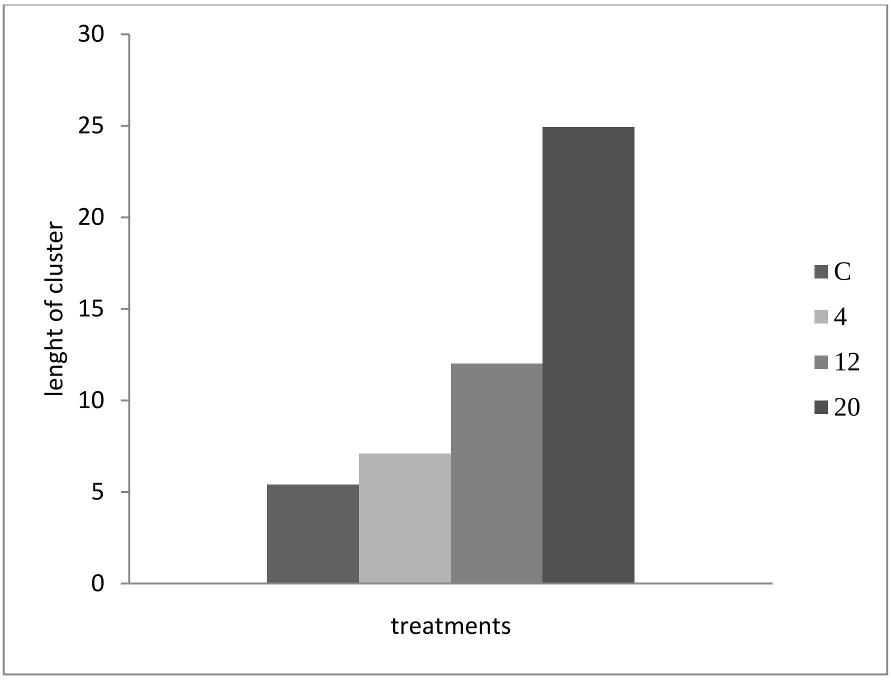

Fig (7.a): Effect of Elixir doses on length of clusters of grape variety Cardinal.

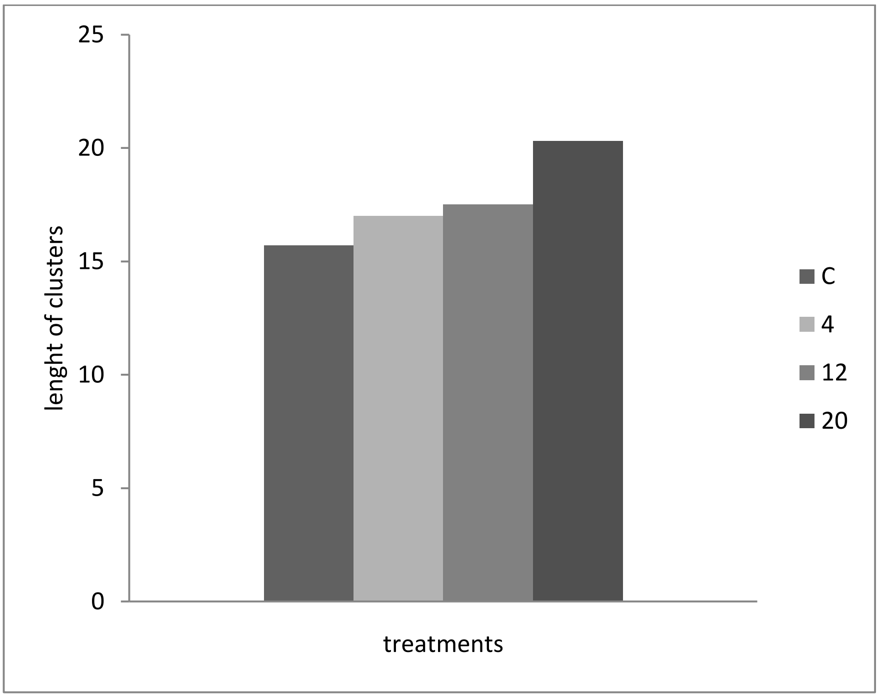

Fig (7.b): Effect of Elixir doses on length of clusters of grape variety Crimson.

It must be the presence of different elements in the soil condition and in sufficient quantities balanced and soft metal to complete the plant needs for better growth and productivity of the plant and that's provided by the bio-activator Elixir. This result agreed with Tsvetkov (2014) who found increase in growth parameters and yield when used some organic substrates.

4.2.4. Cluster weight

Table (1)showed Significant differences in cluster weight of the two varieties of grape were obtained among Elixir treatments tested.The grape variety "Cardinal" recorded the highest cluster weight with the 20ml/plant Elixir while the least cluster weight was recorded with the 4ml/plant Elixir treatment"Crimson" variety however, gave the highest cluster weight with the 20ml/plant Elixir treatment and the least cluster weight was recorded with the control treatment.

Availability and addition of nutrient by Elixir play important role in plant, its increase plant production. It must be the presence of different elements in the soil condition and in sufficient quantities balanced and soft metal to complete the plant needs for better growth and productivity of the plant. This result greed with Tsvetkov (2014) how found increase in growth parameters and yield when used some organic substrates.

4.2.5. Berries quality

4.2.5.1. Number of berries

The effect of the Elixir treatments and variety on number of berries is displayed in Fig. 8. The 20ml/plant Elixir treatment gave the highest number of berries with the grape variety "Cardinal" followed by the 12ml/plant Elixir, the 4ml/plant Elixir, and the control treatments. The

Table(1): Effect of Elixir doses on weight of clusters (g) of two grape varieties. Data taken after 20 weeks from treatment.

Elixir (doses)	**Cardinal**	**Crimson**
0ml/plant	138bc	425b
4ml/plant	119c	467ab
12ml/plant	212b	628a
20ml/plant	265a	756a
LSD	103.6	137.9
CV%	35.3	15.1

Means in a column followed by the same letter(s) are not significantly different at P=0.05, according to Duncan's multiple range test

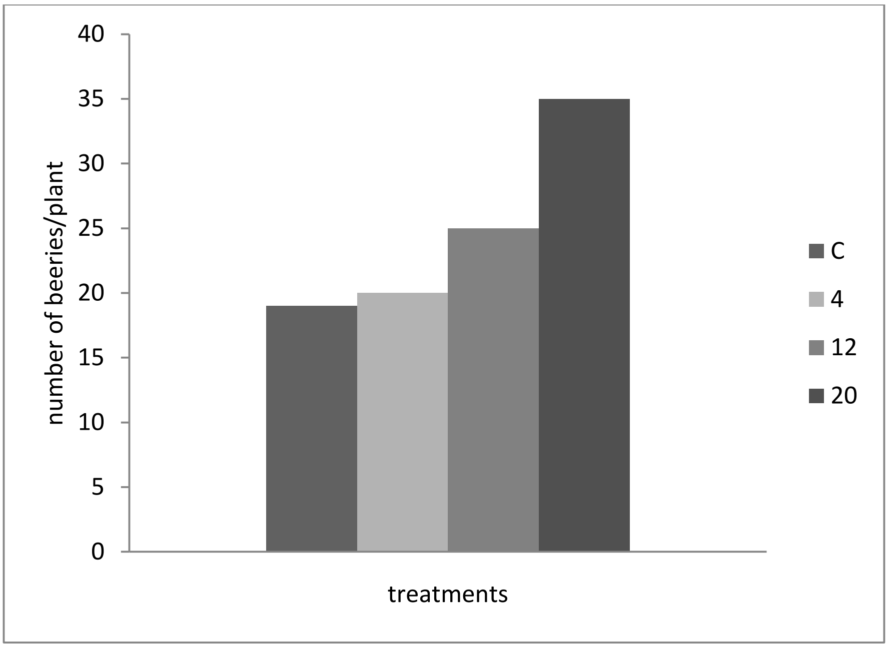

Fig (8.a): Effect of Elixir doses on number of berries of grape varietyCardinal.

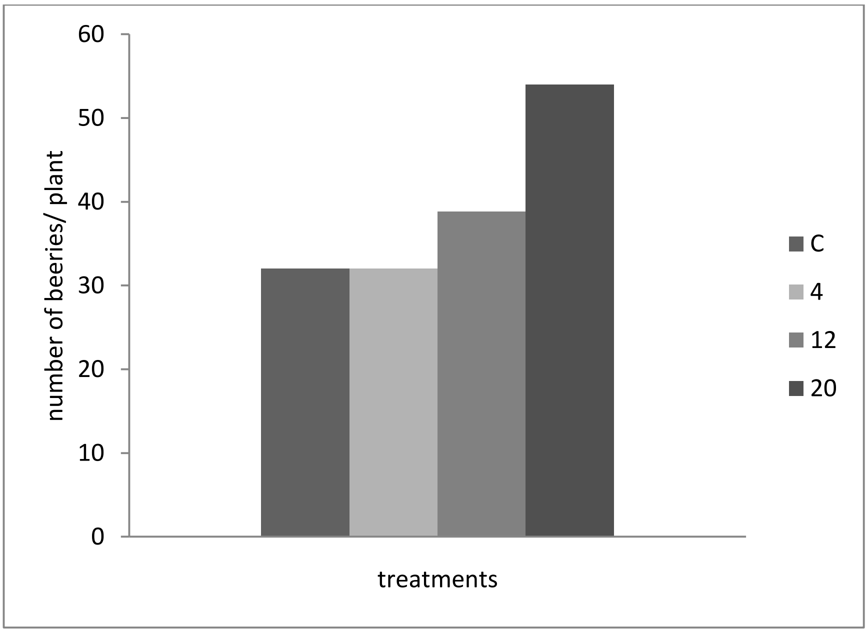

Fig (8.b): Effect of Elixir doses on number of berries of grape variety Crimson.

response of the grape variety “Crimson” followed the same trend in response to Elixir treatments as “Cardinal” variety.

Increase the number of berries per plant after adding Elixir treatments resulted from availability of nutrients and there forms in Elixir fertilization , this led to raising the efficiency of physiological process in plants . All of this led to improve fruit growth and development. This result greed with Akina, *et. al*., (2012) fund increased in quality parameters when used leaf fertilization.

4.2.5.2. Berry diameter

Table (2) presents the data of the effects of Elixir treatments and varieties on the diameter of berries of the grape varieties “Cardinal” and “Crimson”. No significance difference was obtained between treatments or the varieties.

Availability and addition of nutrients by Elixir play important role in plant, its increase plant production. The plants need to grow and give a good growth and abundant productivity to nutrients may not exist in sufficient quantities, or there are not suitable for absorption into the soil. This result greed with Akina, *et.al*., (2012) fund increased in quality parameters when used leaf fertilization .

4.2.5.3. Berry weight:

Data analyses showed significant differences on berry weight, with different Elixir treatments tested on the two grape varieties. The grape variety “Cardinal” recorded the highest berry weight with the 20ml/plant Elixir treatment while least berry weight was recorded with the 4ml/plant Elixirtreatment Fig (9.a) .the grape variety “Crimson” on the other hand, recorded the highest berry weight with the 20ml/plant Elixir treatment

Table (2): Effect of Elixir doses on diameter ofberries of two grape varieties. Data taken after 20 weeks from treatment.

Elixir (doses)	**Cardinal**	**Crimson**
0ml/plant	1.0b	1.0c
4ml/plant	1.1b	1.1c
12ml/plant	1.3a	1.5b
20ml/plant	1.3a	1.8a

Means in a column followed by the same letter(s) are not significantly different at P=0.05, according to Duncan's multiple range test

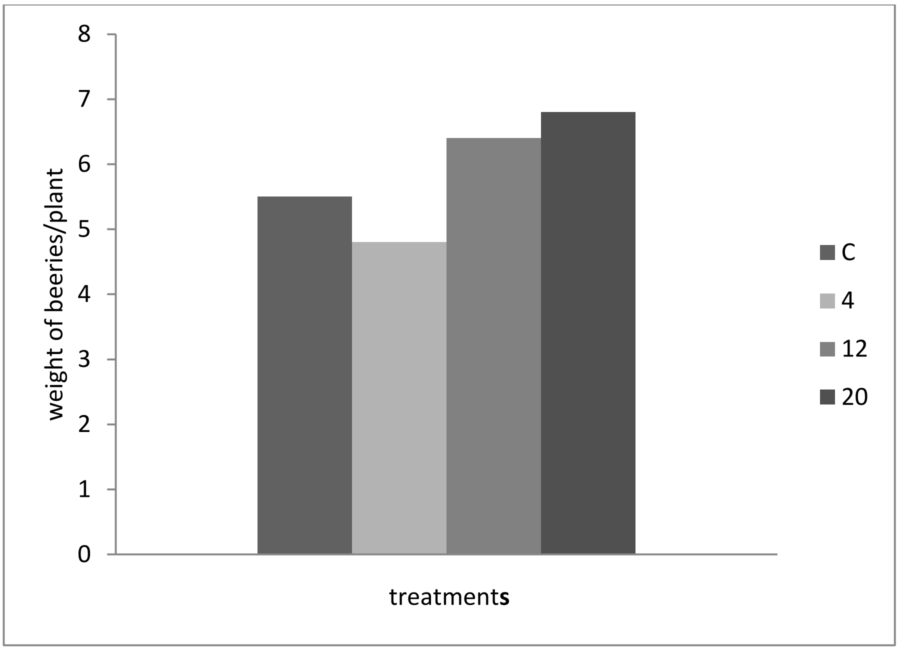

Fig (9.a): Effect of Elixir doses on weight of berries of grape variety Cardinal.

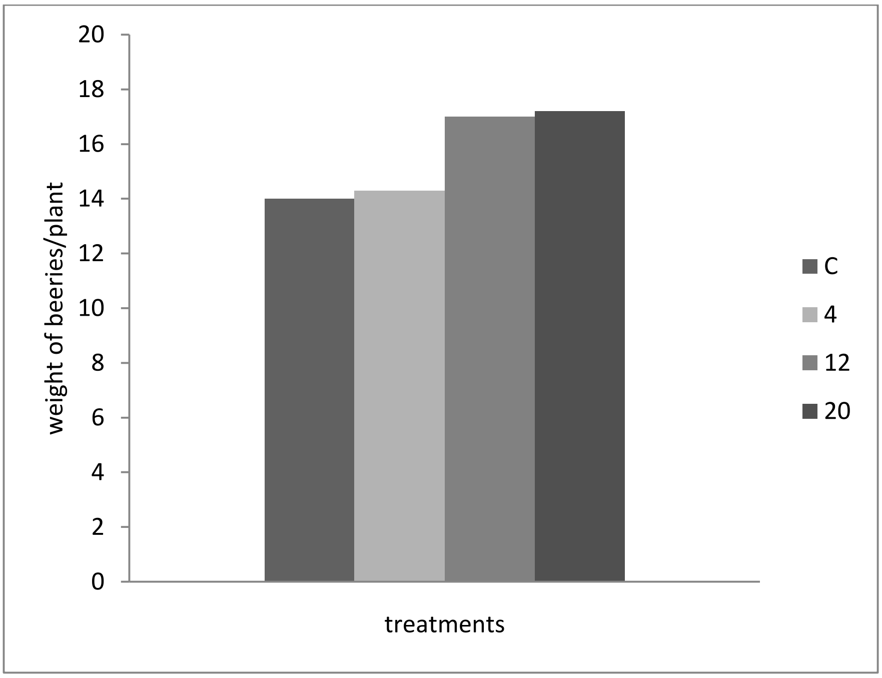

Fig (9.b): Effect of Elixir doses on weight of berries of grape variety Crimson.

while least berry weight was recorded with the control. Fig (9.b) (Table 2).

Availability and addition of nutrients by Elixir play important role in plant, its increase plant production. The plants need to grow and give a good growth and abundant productivity to nutrients may not exist in sufficient quantities, or there are not suitable for absorption in to the soil. This result greed with Akina, *et.al* ., (2012) fund increased in quality parameters when used leaf fertilization.

4.2.5.4. Total soluble solids (TSS).

No significant difference between Elixir treatments was obtained with both grape varieties. The 20ml/plant Elixir treatment gave the highest value for TSS and the least value was recorded with the control treatments in both varieties (Table 3).The total soluble solids showed no significant differences because the amount of dissolved solids genetically controlled in the fruits sugars. Sugar represents mostly with the presence of other substances**.**

4.2.5.5.Total Yield:

Table (4) illustrates the results of the effect of Elixir treatments on yield of two grape varieties. Significant differences were observed between treatments and between varieties. The grape variety “Crimson”, recorded the highest yield with the 12ml/plant Elixir treatment while the least yield was obtained with the 4ml/plant Elixir treatment. The highest yield with “Cardinal” variety was recorded with the 20ml/plant Elixir treatment while the least yield was obtained with the control treatment. Data analysis showed significant differences in yield between treatments in the two grape varieties.” Crimson” recorded the highest yield with the 12ml/plant Elixir treatment while the least yield was obtained with the

Table (3): Effect of Elixir doses on TSS of berries of two grape varieties. Data taken after 20 weeks from treatment.

Elixir (doses)	**Cardinal**	**Crimson**
0ml/plant	19.50b	16.00b
4ml/plant	20.25b	16.00b
12ml/plant	20.57ab	18.25a
20ml/plant	22.00a	18.50a
LSD	2.013	3.157
CV%	6.1	11.5

Means in a column followed by the same letter(s) are not significantly different at P=0.05, according to Duncan's multiple range test

4ml/plant Elixir treatment. The variety" Cardinal" recorded the highest yield with the 20ml/plant Elixir treatment and the least yield with the control (Table 4).

The availability and addition of more nutrients in Elixir enhanced the growth and yield of plants by increase efficiency of physiological and biological process .This study greeted with Sivcev (2005) microbiological fertilizers was increase grapevine yield and improve quality.

Table(4).Effect of Elixir doses on yield (ton/ha) of two grape varieties. Data taken after 20 weeks from treatment.

Elixir (doses)	**Cardinal**	**Crimson**
0ml/plant	0.71b	1.31c
4ml/plant	0.21c	1.22c
12ml/plant	2.62a	3.32b
20ml/plant	2.66a	5.01a
LSD	2.0581	2.515
CV%	82.5	57.9

Means in a column followed by the same letter(s) are not significantly different at P=0.05, according to Duncan's multiple range test

4.3 Soil analysis

When soil analysis, there was no effect on the soil pH due to the difficulty of it down because he travels with irrigation salts to the soil surface, While there was the clear influence of the Ec Table(5) .

Table (5): soil pH and Ec

	pH	Ec
Zero	7.4	4.13
1 dose	7.5	1.80
3 doses	7.5	2.40
5 doses	7.5	0.44

Conclusion:

1- Addition of Elixir improved growth and yield parameters for table grape under saline soils condition.
2- In order to be able to determine the economic optimum yield as related to doses of the Elixir bio-activator, more doses of the bio-activator have to be tested until the relation between Elixir doses and yield are curvilinear.
3- The response of grapesto Elixir is of complex characteristics influenced by several factors including soil type, environmental conditions, and cultural practices under which the plants are grown.

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Appendixs1:

Composition of Elixir

The bioativator Elixir contains consistent set of beneficial micro organism and it contain also essential element for plant growth as follows:

N	1540mg/L
P	18ppm
K	272.4ppm
Ca	800ppm
S	137.19ppm
Mg	120ppm
Mn	102.096ppm
Fe	3439.6ppm
Cu	0.51ppm
Na	73.9ppm
Ph	3-4
Actinomycetes	

Yeast
Fungi