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Influence of Zeolite and Different Irrigation Water on Soil Parameters, Growth and Yield of Carrot

Merlin Seles J.[1], Chitra K.[2]*

[1]Bharathiar University, Coimbatore, Tamil Nadu, India

[2]*Assistant Professor, Bharathiar University, Coimbatore, Tamil Nadu, India.

Corresponding author (*): Merlin Seles J
Email: merlinseles@gmail.com

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Abstract

The soil is one of the major aspects on the surface of the earth. The irrigation of water is its main function and so is helpful for the metabolic activities in plants. The zeolite is one of the volcanic minerals which is found on earth. It acts as a carrier as it stores the nutrients without leaching. For the present study the pot experiment of the carrot plants was conducted. The treatments were given to the carrot plant of different water sources collected from Udhagamandalam, with the zeolite of 40g concentration. The analysis of the soil and the zeolite parameters showed that the soil has nutrients and heavy metals within the critical limit. The structure of zeolite showed crystals also. All the water samples were from fresh water source. The morphological, biochemical parameters of carrot plants were analysed at the end of each month out of 150 days. The result of the treatment of recycle water and zeolite showed the best and high value compared with the other treatments. All the parameters and yield are high in the treatment of recycled water and zeolite. This is due to the reason that the zeolite accumulates the heavy metals present in the recycled water. It was also noted a less value of every assay is seen in the treatment of well water with zeolite due to high salinity.

Key words: Soil, zeolite, carrot, recycled water, well water.

Introduction

The soil occurs naturally and it is composed of some of the various minerals and broken rocks (Peter WB, 1999; Chesworth, 2008). Our environment consists of minerals and organic matter in the soil which can be determined by the chemical parameters of soil (Joffe, 1949). The chemical reaction takes place in the soil and leads to the growth of plant and animal and human development (Ashraf *et al.*, 2012). Soil acts as a natural sink for various pollutants and contaminants. These pollutants or contaminants enter into the soil and interact with the soil thus altering the physical and chemical properties of soil. The soils have the ability to remove the impurities, erase the disease-causing pathogens, and degrade the contaminants. The major function of soil is to absorb oxygen and methane and release carbon dioxide and nitrous oxide. The soil also plays a major role in giving physical support to the plants. The process of conversion of dead organic substances into the nutrients for the plants takes place in soil. Due to the leachate problem the soil gets contaminated with the heavy metals such as lead, zinc, manganese, chromium and cadmium (Hong *et al.,*2002). The heavy metal contaminants sources are industrial wastes, mine wastes, dyes, inks etc. (Erses and Onay,2003).

Every water source used for irrigation consists of some impurities and dissolved mineral salts (Kirda, 1997). The water sources which have mineral salts are good and beneficial to the plant growth and soil conditioning (Silva, 2004). The use of very less quality of irrigation water leads to the negative impact on crop as well as soil as they chiefy depend upon the water, soil and climatic conditions (Hopkins B.G. et al., 2007).

The Carrot (Daucus carota L.) is one of the main root crops during cool season. It comes under the family Umbelliferae. The carrot crop is rich in carotene and it is cultivated in tropical and sub-tropical countries (Veeraraghavathatham et al., 1997). In Tamilnadu, the carrot is cultivated at the main locations such as The Nilgiris and Kodaikanal hills. The Nilgiris is the main area where carrot is cultivated with major 2988 / ha and production of about 44,820 tonnes (Anon, 2014). The cultivated carrots are divided into two types: western and eastern carrots based on the pigments seen in the roots (Razzaq *et al*., 2017). The carrot root is a big source of fibers, carotenoids, vitamins, antioxidants, carbohydrates and minerals (Fe, Ca, Mg and P). Due to high amount of rich nutrients, it gives good health and strength to the humans. (Sharma *et al*., 2012). Some of the environmental stresses lead to the disturbances of qualities of carrot (Razzaq *et al*., 2017). The carrot plant stores the high amount of nitrate and it is known as nitrophilous plant (Sharma *et al*., 2012).

The zeolites are the most valuable gifts to the environment as they are the important part of agriculture, used as a soil amendment (Jakkula, 2005). The zeolites are the three-dimensional crystal structures and they are aluminosilicates. The zeolite was found out by the Swedish mineralogist Freiherr Axel Fredrick Cronstedt. In Greek zeolite means 'boiling stone.' The natural zeolite occurs mostly in volcaniclastic sediments, it absorbs only 55% water and the remaining is used by the plants to perform some of the activities Zeolites (Pisarovic *et al*., 2003). Some scientists have demonstrated that zeolites can be used not only as inorganic fertilizer but also as organic fertilizers which slowly release their nutrients (Perez Caballero *et al*., 2008). Zeolites are used in agriculture mainly for fertilizer management and as soil conditioners as they increase the crop yield too (Noori *et al*., 2006). Zeolites act as stabilizers, in addition to being fertilizers (Lizidou and Kapetanios, 1992; Perez-Caballero *et al*., 2008). The Clinoptilolite enhances the nitrogen fertilization efficiencies and it decreases nitrate leaching (Perrin *et al*., 1998). The zeolite can be applied in different varieties of soil to enhance the crop yield of some of the vegetables such as carrots, potatoes, tomatoes and eggplant (Burriesci *et al.,* 1984; Yapparov *et al*., 1988; Ghannad *et al.*, 2014).

Materials and Methods

The pot experiments were conducted during April to August nearly 150 days at the location of Nilgiris. The zeolite was commercially purchased and used as a treatment with the application 40g per pot. The water treatment is also given. The treatments were without zeolite as a control, with zeolite four treatments each with three replication (15 pots in total). During the experiment the irrigation water such as tap, canal, bore well, recycle, and well water to the whole period were carried out. The soil sample was collected from the area of Nilgiris hills. The collected soil samples were brought to the Bharathiar University Laboratory and it sieved and stored. The physicochemical parameters, heavy metals, SEM structures were analysed. The structure of zeolite was analysed through SEM, XRD, FTIR and the quality also analysed.

Soil physical parameters

Soil texture: - Hydrometer (Bouyoucos, 1927), Soil color:- Munshell-colour chart,Soil structure:- SEM, XRD analysis.

Soil Chemical parameters

Soil pH -Potentiometric 1:2 (Jackson, 1973), EC-electrical conductivity method, Organic matter - Walkely and Black (Walkely and Black, 1934), Macronutrients (N, P, K) - Atomic absorption spectrophotometer, Micronutrients - DTPA (Lindsay and Norvell, 1978), Heavy metals - Wet digestion method by ICPMS

Plant sampling and measurements

The morphological parameters, fresh and dry weight, total leaf area of carrot plant was measured at the end of each month. The chlorophyll content was determined. The biochemical parameters such as carbohydrates, protein, phenol, of carrot plants were estimated. The yield of carrots was recorded.

Biochemical parameters

Estimation of chlorophyll

This assay was done by the method (Arnon, 1949). One gram of fresh leaves was ground up by 20-40 ml of 80% acetone. Then it should be centrifuged at 5000 –10000rpm for 5mins. This procedure is continuously repeated to become colourless. The optical density was taken at the absorbance of 645 nm and 663nm against the solvent (acetone) blank. The amount of chlorophyll a, chlorophyll b and total chlorophyll were calculated using the following formula: Total Chlorophyll: 20.2(A645) + 8.02(A663)

Chlorophyll a: 12.7(A663) – 2.69(A645) , Chlorophyll b: 22.9(A645) – 4.68(A663)

Estimation of carbohydrates

The total carbohydrate content was determined by the method of Hedge and Hofreiter, 1962. The 100 mg of the sample is weighed and it was hydrolysed in a water bath for 3 hours with 5.0 ml of 2.5 N HCl and cooled to room temperature. Then it should be neutralized with sodium carbonate till the effervescence stops and it should be made upto 100ml and centrifuged. The supernatant was collected and take 0.2 to 1.0 ml for analysis. Prepared the standards by taking 0.2-1.0 ml of the working standards. 1.0 ml of water serves as a blank made up the volume to 1.0 ml in all the tubes with distilled water, then added 4.0 ml of anthrone reagent, heated for few minutes in a boiling water bath, cooled rapidly and read the absorbance at 630 nm.

Estimation of protein

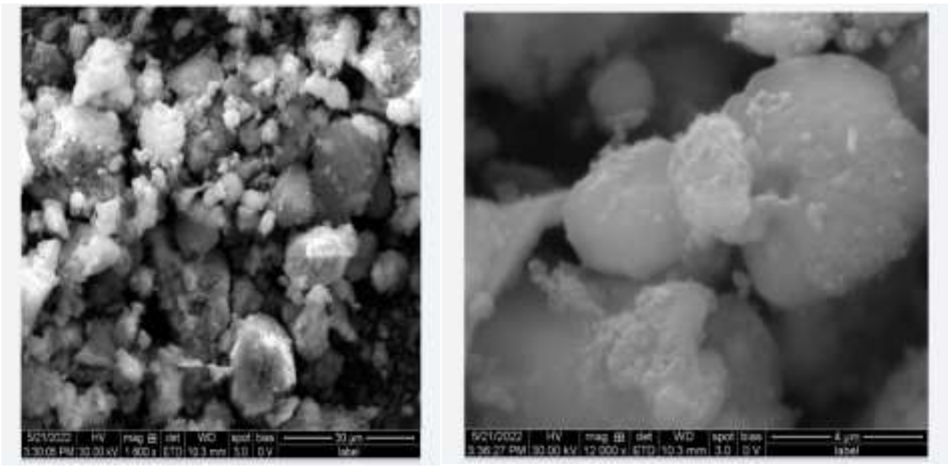
The bovine serum albumin is used as standard. The extract is added to 4.5 ml of reagent 1 (48 ml of 2% sodium carbonate in 0.1N sodium hydroxide + 1ml of 1% sodium potassium tartrate + 1ml of 0.5% copper sulphate) and then kept in darkness for 15 min. After this, 0.5 ml of freshly prepared reagent 2 (1-part FolinCiocalteau: 1 part water) was mixed with each sample and kept for 30 min of dark incubation. The absorbance was measured at 660 nm and the amount of protein is expressed as mg BSAE/ g of fresh weight (Lowry, 1951).

Total phenol

The crude extract of carrot plants was determined by folin- ciocalteau reagent with some changes. 1 ml of extract (1 mg mL^{-1}) was added to 2.5 mL of Folin–Ciocalteu (10%) and 2 ml of sodium carbonate 2% (Na_2CO_3). The mixture was kept in darkness for 15 minutes. After incubation the optical density was taken at the absorbance 765 nm. The gallic acid was used as a standard (Singleton, 1965).

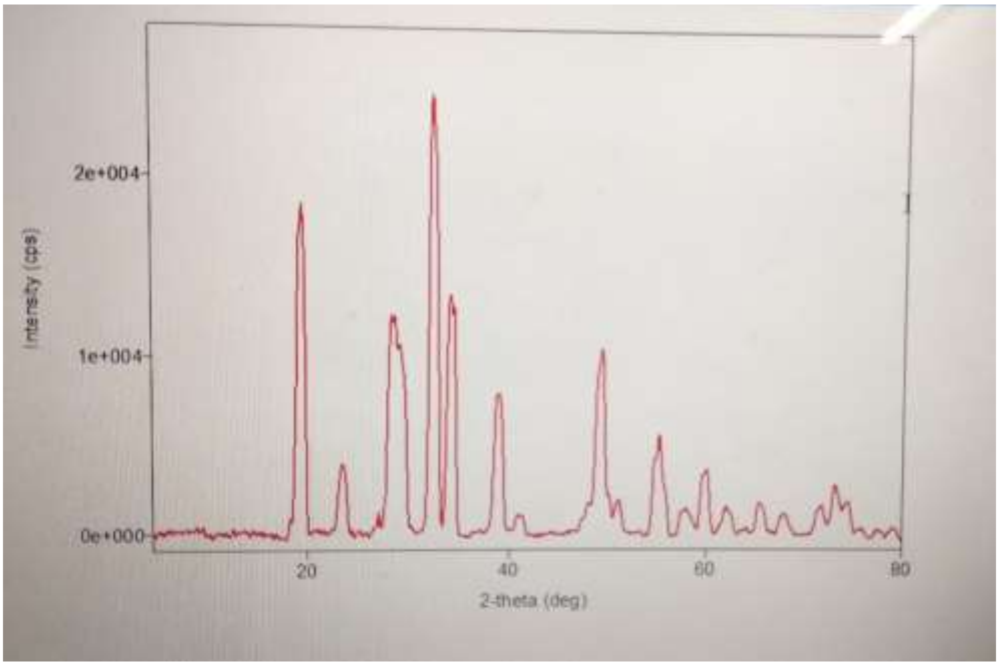
Results and Discussion

The structure of zeolite



The elaboration of the dividing capacity shows the individual plates are bars and not separate crystal grains of the clinoptilolite. Hence it shows only the aggregates seen as fine powder of the mineral. The clinoptilolite cleavage occurs while splitting of zeolite into fine grains (Kowalczyk *et al*., 2006). The grains of the clinoptilolite consists of fine crystal structure with the size of 50 × 300 × 700 nm (Sprynskyy *et al.,* 2010). Other researchers have found out sub-micron sizes of separate grains of clinoptilolite (Sprynskyy *et al*.,2010). The result of the present study showed that the structure of clinoptilolite is crystal.

XRD of zeolite

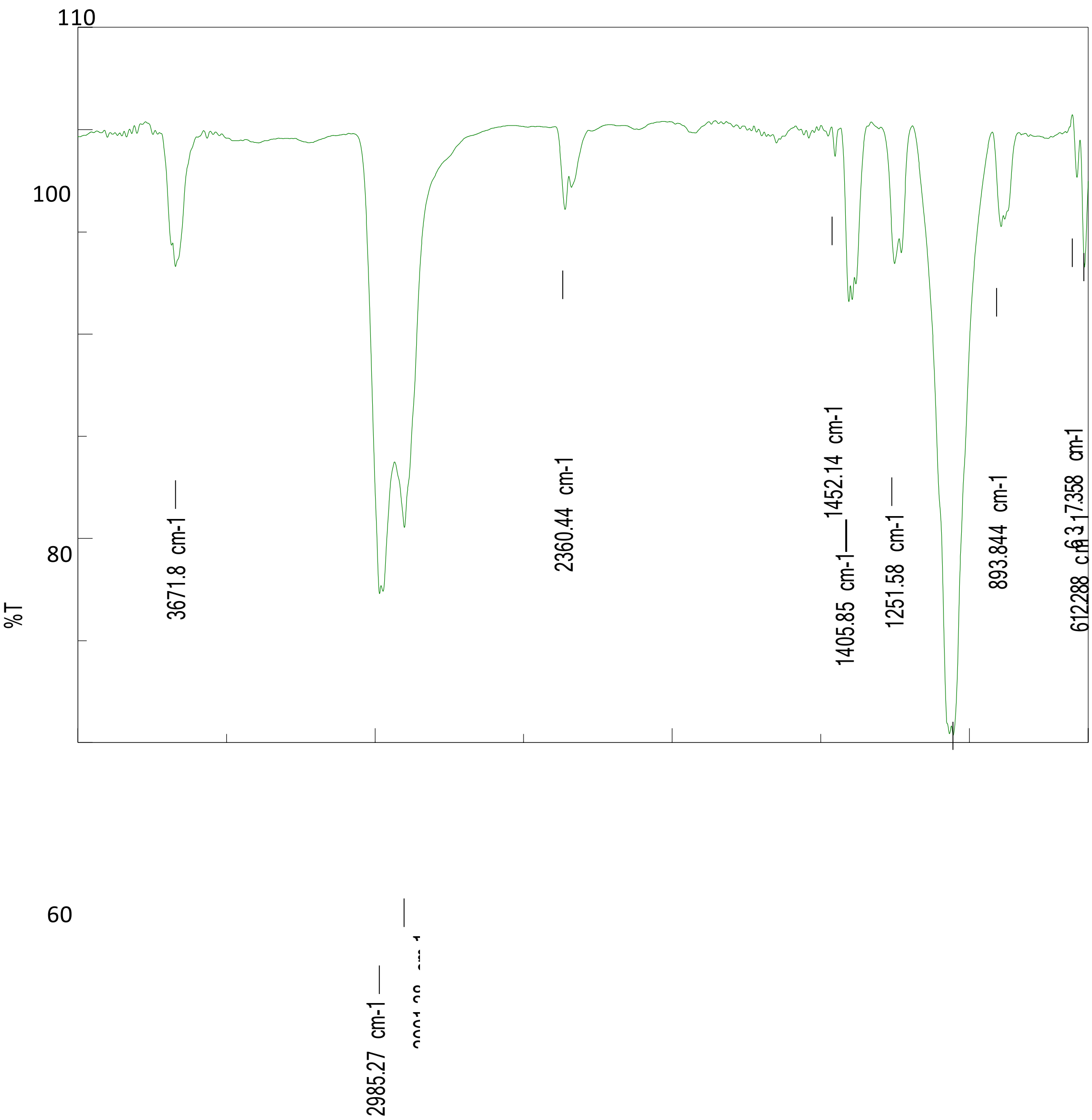


The XRD is used to identify the crystallinity of the volcanic mineral zeolite. The x ray peaks were obtained for X-ray 2θ values from 20°-80° shows in the figure. The sample was made up into the fine powder. The determination of XRF analysis result showed that natural clinoptilolite have 75.68% SiO2, 14.23% Al2O3, 0.68% Na2O, 2.19% K2O, 3.55% CaO, 1.60% MgO, 1.70% Fe2O3 and 0.351% for other elements such as Ti, P, S. Si/Al mole ratio of zeolite was recorded within typical limits (4-5.25) for clinoptilolite (ranjbar et al., 2004; krutilina et al ;2000). In this XRD analysis clinoptilolite is the main mineral in the sample. The sharp diffraction of the given sample in XRD shows the presence of clinoptilolite.

FTIR study of zeolite

The strong peak between 1000 and 1400 cm-1 that is nearer to 1030 cm-1 which represents the bonds of Si-O or Al-O in the clinoptilolite structure (Runping *et al*., 2009). The FTIR structure band joined within the internal Si–O(Si) and Si–O(Al) is tetrahedral or alumino and silico-oxygen present within the range of 1200–400 cm1. The band of zeolite water is present in the range of 1600–3700 cm1 . There are many types of zeolitic water. The figure shows the FTIR spectrum of natural zeolite ranges from 358 to 3671.8 cm-1.

The FTIR study of natural zeolite mainly clinoptilolite has four groups of bands (Pechar ,1985): 1. The bands connected with the silicon and aluminium Si–O (Si) and Si–O(Al) is said to be tetrahedra or alumino and silico- oxygen bridges (the range of 1200– 400 cm21). 2. The bands are formed due to the presence of zeolite water (the range of 1600–3700 cm21). 3. The bands are connected due to the pseudo-lattice of structural units (the range of 500–700 cm21). 4. The bands are connected with lattice (below 400 cm21) The result of the present study showed there is mainly presence of elements such as silicon, aluminium, and oxygen according to its wavenumber. In this clinoptilolite FTIR study the peak of wavenumber starts from 358-3671.8 cm-1



Zeolite physical and chemical properties

Zeolite	Specific gravity (g/cm^3)	Bulk density (g/cm^3)
Clinoptilolite	2.15-2.25	1.15

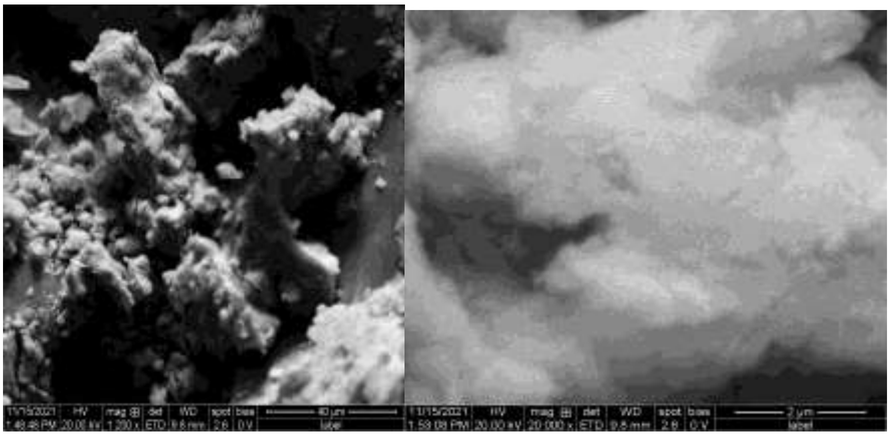
Physical characteristics of some naturally occurring zeolites (after Doğan, 2003)

Zeolite	Specific gravity (g/cm^3)	Bulk density (g/cm^3)
Clinoptilolite	2.6	0.4-0.5

The value of specific gravity and bulk density of clinoptilolite was present below the limit value. (Wang *et al.*, 2009) found out that the increase of removal of heavy metals which increases the specific surface area of zeolite. The specific surface of the zeolite can be divided into two areas they are external and internal. The internal specific area of zeolite is the area of size and distribution of pores. The external specific surface area is increased by the grinding processes and it does not increase the internal specific area (Oren, 2006). The specific surface surface area of the clinoptilolite is 19.2m^2/g.

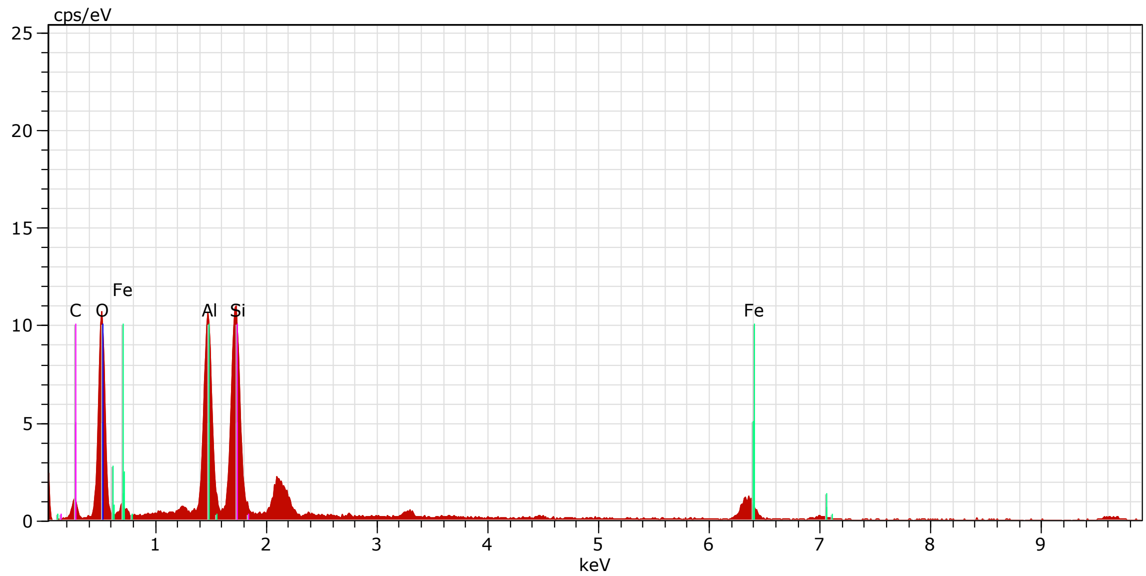
The presence of chemical composition of zeolites differ mainly depend on their origin, the contents are Na2O, K2O, CaO, SiO2, Al2O3, and Fe2O3. For example, zeolite originated from Naples: 52.15% SiO2, 2.35% CaO, 7.54% K2O, 18.56% AlO3, 3.30% Na2O, 0.20% FeO3, 0.20% MgO, 212 CEC (cation-exchange capacity (cmol (p+) kg−1)), 2.18 SiO2/Al2O3; zeolite originated from Argentina: 62.70% SiO2, 0.40% CaO, 1.20% K2O, 12.50% AlO3, 6.40% Na2O, 0.60% FeO3, 0.60% MgO, 175 CEC (cation-exchange capacity (cmol (p+) kg−1)), 5.02 SiO2/Al2O3 (Ramesh *et al*., 2007). The chemical composition of the clinoptilolite they are SiO2-52, Al2O3-46, Fe2O3-0.6, TiO2-0.65, CaO-0.09, MgO-0.03, Na2O-0.1, K2O- 0.03.

Soil structure



The scanning electron microscopy studies were undertaken many times to identify surface structure and their differences (Benjamin *et al*., 1978., Hayat, 1978, Goldstein *et al*., 2018). The point analysis can be done through X-ray spectrometer (Goodhew *et al*., 2001; Echlin, 2009; Gira *et al*., 2017; Bergstron, 2015). The present study showed that soil is a cluster in shape and this structure is closely grouped to form aggregates.

Downs found out that it is common to determine the types of minerals seen in the soil which contains a group of mixture of soils, using just two peaks (Downs *et al*., 1993). The main important mineral is silicon. According to Karine , the interaction between the x ray and minerals, shows the result of the outputs with only a few mineral peaks (Karine *et al*., 2005). This soil consists of minerals such as carbon, oxygen, iron, aluminium and silicon.



Soil Physical Parameter	
pH	6.2
EC	0.07

Texture	Sandy clay loam
OC%	0.02
Macro nutrients (kg/ha)	
Nitrogen	98.84
Phosphorus	24.7
Potassium	222.39
Micro nutrients (ppm)	
Iron	5.31
Manganese	4.00
Zinc	1.30
Copper	0.40
Heavy metal contamination (ppm)	
Cadmium	1.483
Chromium	1.094
Lead	3.739
Nickel	1.332
Arsenic	0.012

The pH is one of the physical properties of soil. It has some of the effects such as solute concentration and absorption (Akpoveta OV, 2010). pH is one of the important parameters which is helpful to identify the availability of plant nutrients such as iron, manganese, zinc and copper. They are present in greater amounts in acidic than alkaline soils (Deshmukh, 2012). pH is used to maintain equilibrium of the nutrients in soil. Williams has found out that high pH level affects the micronutrients in soil (Williams DA, 1990). . At low pH level the presence of micronutrients is high and at the high pH level the availability of micronutrients is reduced (Brady, 2002). The present study shows that the pH value is acidic in condition.

The EC is an easy and simple method to find out the health of the soil. It is used to measure the salinity. If the value of electrical conductivity is less than 1 (dS/cm) it is said to be normal soil, and if it is 1-2 (dS/cm) , it is said to be the critical level for germination, 2-3 (dS/cm) it is said to be the critical level for the growth of salt sensitive crops and greater than 3(dS/cm) it becomes the severely injurious to crops. (Deshmukh, 2012). The result showed that the electrical conductivity of the soil is less than 1(dS/cm).

Soil consists of various textural groups based on the size of the soil particles. The soil texture has the capacity of water relation, aeration, and root penetration. On the basis of the electrical conductivity also, soil structure can be identified. The sandy soil is a very poor conductor and the clayey soil is highly conductive (Marx, 1999). The texture of black soil is both loamy and clayey, for the red soil it is silty , clayey and loamy, and for yellow soil it was loamy. The soil texture is very crucial as it affects the nutrient supply of the soil (Gupta, 1991). The result showed that the texture of the soil is sandy, clayey and loamy

When the range of organic carbon content is < 0.50 %, it is found to be low in carbon and if the range is > 0.75 %, the soil is considered to be rich in carbon31. Soil organic carbon contains the remaining substances such as degraded plants, humus, and charcoal (Lal, 2007). The result of the present study showed that the organic carbon is less than 0.50% Therefore, the soil is said to be low in carbon.

Critical limits for macro nutrients

Macro nutrients	Low	Medium	High
Nitrogen	< 280	280-560	> 560
Phosphorus	< 22.5	22.5-55	> 55
Potassium	< 140	140-330	> 330

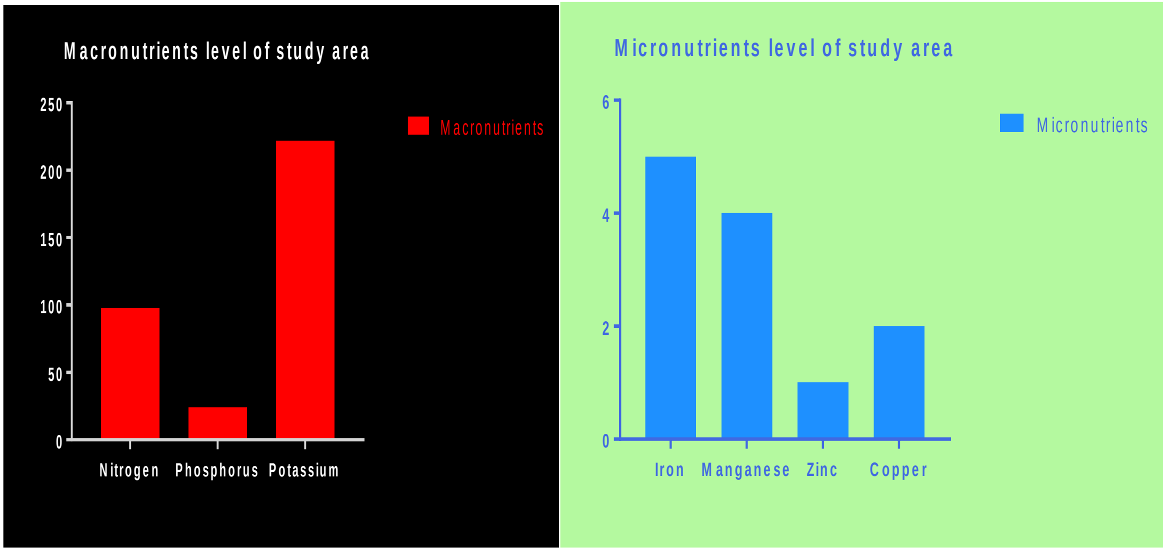
The result showed that the value of nitrogen was present below the low level. The phosphorus was present at the medium level. The potassium was present below the high level. Hence, the values of macro nutrients were not exceeding the high level. and the critical limits are presented in the table below.

Critical limits for micro nutrients

Nutrients (mg/g)	Very low	Low	Marginal	Adequate
Iron	<2.50	2.50-4.50	4.50-7.50	>7.50
Manganese	< 1.00	1.00-2.00	2.00-4.00	> 4.00
Zinc	< 0.30	0.30-0.75	0.60-1.50	> 1.50
Copper	< 0.10	0.10-0.20	0.20-0.40	> 0.40

Singh (1998)

The result of the present study of micronutrients showed that the value of iron content was present at the marginal levels. The values of manganese and copper were also present at the marginal level. The value of zinc too was present at the marginal level. Therefore, the values of micronutrients are present within the adequate levels.



Heavy metals (mg/g)	Threshold limit	Permissible limit
Cadmium	1.0	10.0
Chromium	100.0	200.0
Lead	60.0	200.0
Nickel	50.0	100.0
Arsenic	5.0	50.0

The universal agencies such as World Health Organization (WHO), European Regulatory Standards (EURS) and United States Environmental Protection Agency (USEPA) have set some optimum limits for heavy metals. WHO have a maximum permissible limit for soil samples they are chromium 100 mg/kg; cadmium 0.8 mg/kg; copper 36 mg/kg, zinc 50 mg/kg, and lead 85 mg/kg (WHO, 1996). The result of the present study of heavy metals show the value of cadmium present between the threshold and permissible limit. The values of chromium, lead, nickel, arsenic are present within the threshold limit.

Irrigation water

The main sources of irrigation are canal, tanks, well. The canal irrigation is a manmade channel which the farmers utilise in the agricultural fields. Israel is one of the developed countries where the people reuse the wastewater for irrigation (Chand JB *et al.,* 2021, Friedler E,2001). Some scientists have substantiated the fact that the usage of recycled water has many positive advantages for farmers, such as crop improvement and nutrient supply to the crops (Chand JB *et al.*, 2021; Biswas *et al.*, 2002). The recycled water cannot be used for drinking purposes. The recycled water consists some of the heavy metals and the phytotoxicity in it will create negative effect on agriculture (Pereira *et al.*, 2002). The well water has the characteristics of salinity. But the recycled water has one great plus point i.e., high amount of minerals. The result showed that the treatment of zeolite and recycled water was best in all the parameters and this is due to the fact that zeolite, trapping every toxicity and heavy metals, gives the nutrients to the crops.

The morphological parameters of carrot crop

The growth rate of carrot crop increased periodically from 30-60, 60-90, 90-120, 120-150 days in all the treatments. Mainly in the treatment of recycled water and zeolite the growth rate of carrot crop showed higher value. The lesser value showed in the treatment of well water and zeolite. (Saha *et al.*, 2017) reported that the reason for increase in plant height is due to the more presence of nitrogen. This nitrogen is released from the zeolite pores and thus helps in the reduction of nitrogen content. The nitrogen is an essential element and it is capable of enhancing cell division, and it affects positively the plant height which might be due to intake of higher amount of nitrogen and soil nutrients such as N, P and K. The application of zeolite to the soil improves the nutrient and water availability to plant root and it helps to increase the absorption of nutrients and water which lead to the growth, elongation of cells and stimulate cell division, expansion and increase the number of leaves (Nisreen *et al.*, 2020).

Table :- 1 Shoot length

Water samples (cm)	30 days	60 days	90 days	120 days	150 days
Control	4.33±0.52	11.33±0.15	20.33±0.04	23.14±0.41	27.43±0.21
Canal	7.33±0.57	15.00±0.15	24.12±0.03	28.23±0.32	30.16±0.14
Bore well	5.34±0.57	13.02±0.12	18.32±0.04	27.14±0.41	28.31±0.14
Well	2.83±0.76	9.24±0.11	14.23±0.03	18.36±0.32	25.52±0.62
Recycle	8.43±0.74	15.23±0.15	28.18±0.04	30.16±0.21	32.18±0.32

Table :-2 Root length

Water samples (cm)	**30 days**	**60 days**	**90 days**	**120 days**	**150 days**
Control	3.83±0.44	4.0±0.13	5.66±0.21	7.75±0.21	8.14±0.14
Canal	4.73±0.04	5.0±0.23	7.65±0.31	9.21±0.32	11.14±0.61
Bore well	3.9 ± 0.85	3.93±0.14	6.43±0.14	8.32±0.43	9.10±0.82
Well	3.66±0.53	3.0±0.42	4.32±0.34	5.14±0.41	6.14±0.14
Recycle	5.33±0.70	5.52±0.32	8.32±0.31	11.21±0.32	12.32±4.51

Table :-3 Fresh weight

Water samples (g)	**30 days**	**60 days**	**90 days**	**120 days**	**150 days**
Control	0.014±0.002	0.053±0.015	1.398±1.234	6.10±1.14	18.12±0.18
Canal	0.163±0.133	0.090±0.123	3.143±1.684	10.12±2.16	23.46±3.87
Bore well	0.152±0.004	0.070±0.017	0.754±1.543	7.16±3.43	20.18±0.19
Well	0.012±0.003	0.030±0.019	0.487±3.143	5.12±0.16	16.20±0.16

Recycle	0.183±0.143	0.100±0.018	4.963±2.164	12.10±1.16	25.20±0.16

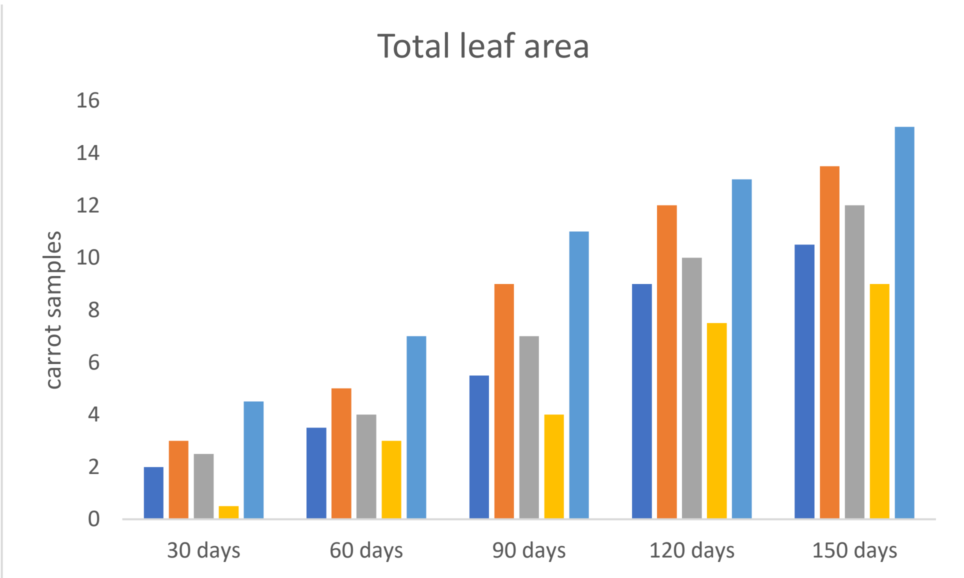
Table :- 4 Dry weight

Water samples(g)	30 days	60 days	90 days	120 days	150 days
Control	0.026±0.002	0.036±0.008	0.22±1.437	1.46±0.13	4.16±0.16
Canal	0.032±0.004	0.048±0.007	1.43±1.571	4.16±0.63	5.18±1.63
Bore well	0.028±0.006	0.040±0.008	0.32±0.581	2.23±0.74	6.23±0.16
Well	0.018±0.132	0.020±0.009	0.16±1.387	0.97±1.56	2.16±0.18
Recycle	0.039±0.142	0.058±0.007	2.57±0.678	5.43±0.72	7.24±0.16

Table :-5 Total leaf area

Leaf samples (cm)	30 days	60 days	90 days	120 days	150 days
Control	2	3.5	5.5	9	10.5
Canal	3	5	9	12	13.5
Bore well	2.5	4	7	10	12
Well	0.5	3	4	7.5	9
Recycle	4.5	7	11	13	15

Figure:-1



The increase of total area is seen in the recycled water leaf samples and it decreases in the well water samples.

The biochemical parameters of carrot plant

The chlorophyll is an important pigment and it plays a major role in the process of photosynthesis, and due to the changes in chlorophyll pigment it leads to the photosynthetic efficiency (Taiz & zeiger.,2006)). The present study proved the total chlorophyll content is seen higher in the treatment of zeolite and recycled water. The carbohydrate plays a vital role in plant metabolism (Tisdale *et al*., 1975). The presence of zeolite and the micro and macro nutrients in the soil helps to improve the plant building metabolites and increase the nutrients uptake of plants.

According to (Krutilina *et al.*,2000) , studies on Barley, Maize and (Ranjbar *et al.,* 2004) Tobacco proved that, the application of zeolite enhances the photochemical activity of chloroplasts, total chlorophyll content and total carbohydrate content. Due to the increase in the level of zeolite in soil, water absorption and nutrients are increased and improved which are helpful for the growth and the elongation of cells. This occurs due to the entry of nitrogen in the formation of protein and nucleic acids such as DNA and RNA. With the presence of zeolite and increasing the absorption of nitrogen leads to the enhancement of biological processes such as enzymes, proteins and chlorophyll (Faraj and Jadouh, 2015). The value of all the biochemical parameters is seen higher in the treatment of zeolite with recycled water.

Figure:-2

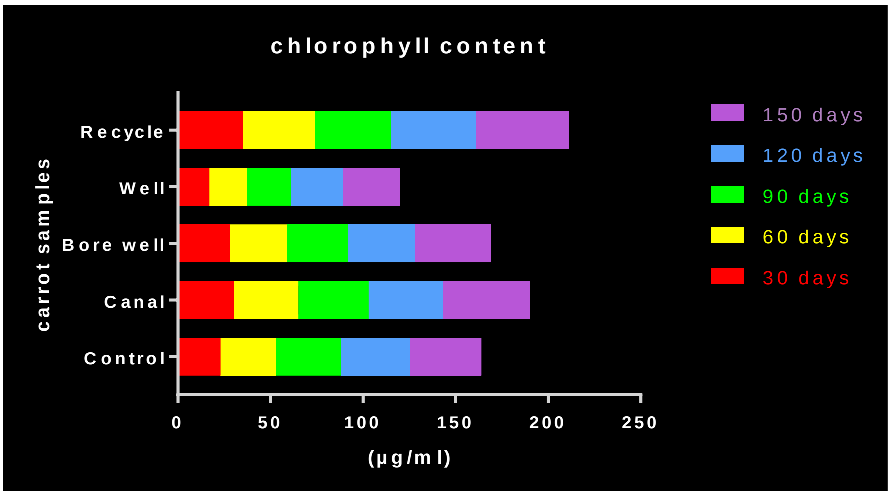


Figure:-3

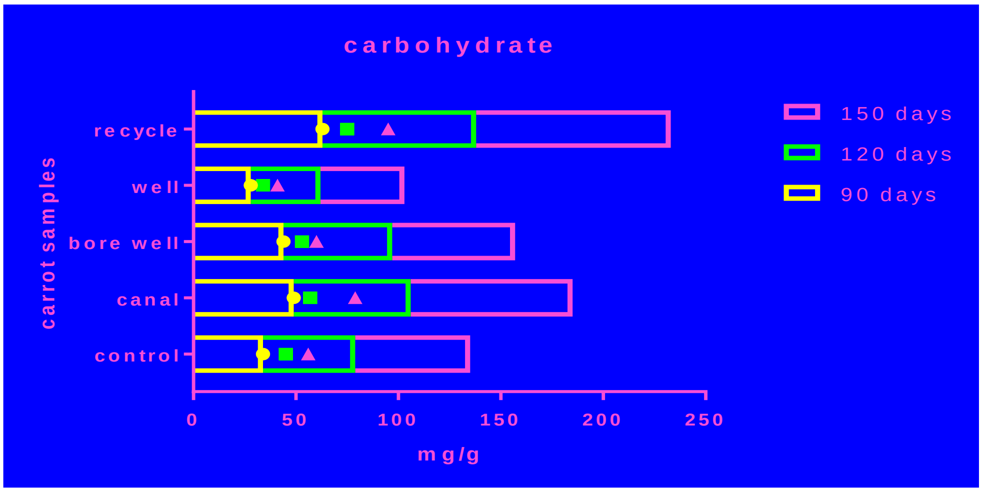


Figure :-4

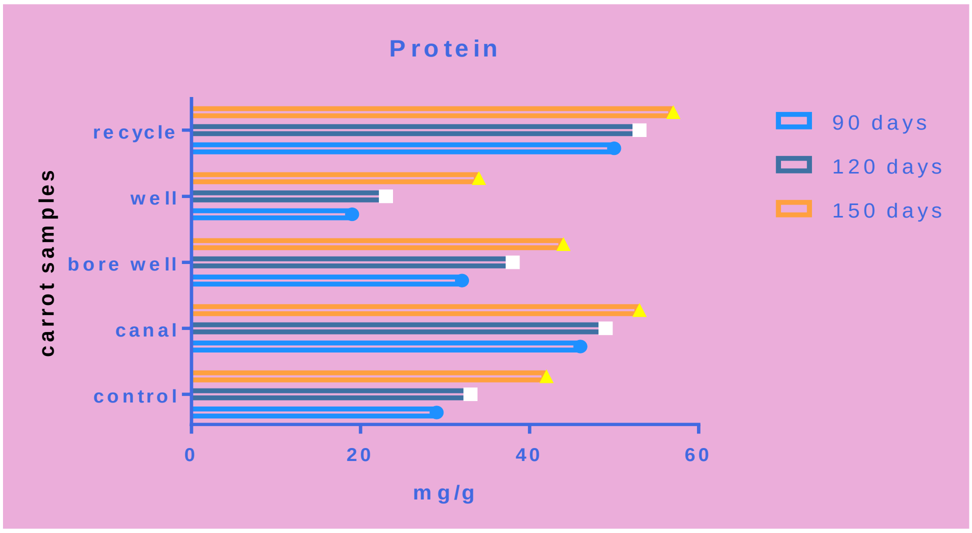
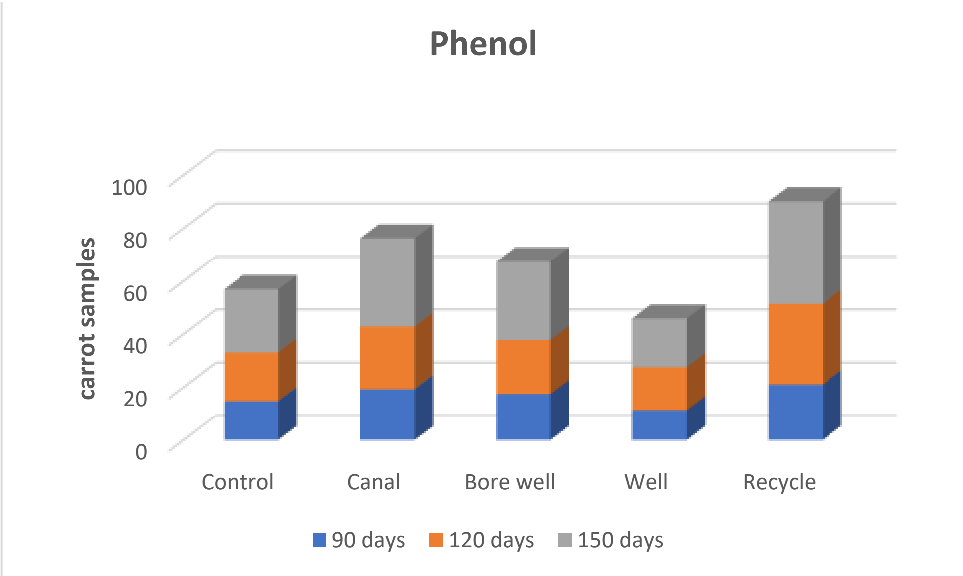


Figure:- 5



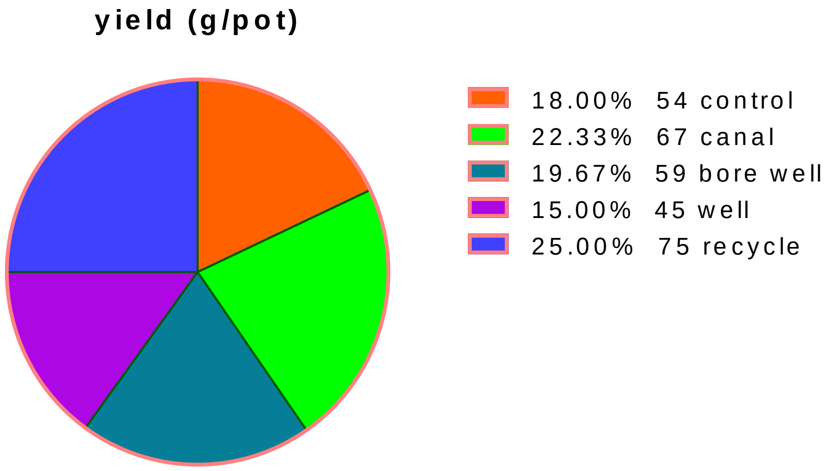
Seedling stage 30 days

60 days 90 days

120 days 150 days

Yield of the carrot plant

Carrot samples	**Yield (g/pot)**
Control	54.97
Canal	67.30
Bore well	59.76
Well	45.67
Recycle	75.10



(Junrungreang *et al*.,2002) reported there is no effect of zeolite in the sugar cane and the sugar content, and (Ozbahce *et al*.,2015) found that protein content in bean. However, both authors found that there is a positive effect of zeolite for yield. (Nadia, 2005) and (Ghanbari *et al.,*2007) both observed that there is increase in yield when irrigated with wastewater instead of well water for the crops such as sorghum and wheat. Therefore, the waste water contains high amount of nutrients. The present study shows the positive result of yield of carrot and the better effect in the treatment of zeolite and recycled water treatment.

Conclusion

In the above study focused on carrot plants, the treatments were done with water and zeolite. The best result was seen in the treatment of recycled water and zeolite. It was also established that the growth, the biochemical parameters were less in the treatment of well water and zeolite. This is due to the reason that zeolite traps the heavy metals which assure successful and enhanced plant growth.

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