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Effects of Different Fertilization on Soil Quality and Tomato Crop (Lycopersicon Esculentum Mill.)

Dost Jan
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Abstract

The study's goal was to examine "effects of different fertilization on soil quality and tomato crop (*Lycopersicon esculentum Mill.*)" during the kharif 2021 growing season. Treatments for nitrogen and potassium fertilizers among the alternatives were 0-0 kg ha^{-1}, 50-30 kg ha^{-1}, 70-40 kg ha^{-1}, 90-50 kg ha^{-1}, 110-60 kg ha^{-1}, and 130-70 kg ha^{-1}. Randomized complete block designs were used set up the experiment with three replications. In this trial, the tomato was assessed for soil quality, numerous growth, yield, and fruit quality. Different amounts of NK fertilizers had a significant impact on all soil quality, fruit quality, and productivity ($P<0.05$). Nitrogen (N) and Potassium (K) fertilizers applications were applied @130-70 kg ha^{-1} NK fertilizers and 110-60 kg ha^{-1} NK fertilizers, with comparable the soil pH, soil EC (dSm^{-1}), total nitrogen (%), available phosphorus, and available potassium of the tomato soil were all calculated, as well as the number of branches plant^{-1}, days to flowering, days to fruiting, number of fruits plant^{-1}, single fruit weight (g), yield plot^{-1} (kg), and yield ha^{-1} (tons). The crop applied with the most NK fertilizers (130-70 kg ha^{-1}) produced the high soil pH (8.04), soil EC (1.54 dSm^{-1}), total nitrogen (%) (0.42), available phosphorus (4.17), available potassium (120.94), followed by crops with (110-60 kg ha^{-1}) NK fertilizers produced soil pH (7.98), soil EC (1.38 dSm^{-1}), total nitrogen (%) (0.41), available phosphorus (4.14), available potassium (120.50), while the lowest soil pH (7.64), soil EC (0.88 dSm^{-1}), total nitrogen (%) (0.25), available phosphorus (4.017), available potassium (119.61) produced in no fertilizers (0-0) application, respectively. The crop fertilized with (130-70 kg ha^{-1}) produced the largest single fruit weight (56.57 g), followed by crops grown with the least NK fertilizer (110-60, 90-50 and 70-40 kg ha^{-1}) producing 54.40, 50.067, and 49.833 (g), respectively. The crop fertilized (130-70 kg ha^{-1}) NK fertilizers, the most yield ha^{-1} (15.20 tons), followed by crops with 110-60 kg ha^{-1}, 90-50 kg ha^{-1}, and 70-40 kg ha^{-1}, which produced 15.133, 14.067, and 13.57 tons, respectively. The tomato soil quality, crop growth, and yield were somewhat greater in crops fertilized using NK fertilizers levels of 130-70 kg ha^{-1}, however, there are distinctions between quantitative and qualitative data attributes when they were compared, they were non-significant to crops treated with NK fertilizers at the rate of 110-60 kg ha^{-1} is lower. As a result, an optimal level of NK fertilizers concentrations of 110-60 kg ha^{-1} were established to produce economically superior soil quality and tomato fruit yield quality.

Keywords: Soil quality, tomato crop, nitrogen, potassium fertilization

Introduction

Tomatoes (Lycopersicon esculentum mill.) are a team member salicaceae family and are one of the majority of extensively consumed vegetables on the planet, as they can be eaten raw or cooked a variety of forms that have been processed. After potato and sweet potato, tomato is the greatest general and third most eaten vegetable on the world, in terms of worldwide vegetable production (Joint FAO, 2002). Tomatoes are an important crop in Pakistan, despite the fact that it generates only 0.3 percent of worldwide tomato supply and has a tiny proportion of global trade. The results of surveys of tomato growing farmers in Sindh, Balochistan and Punjab are shown below. They discovered the production of tomato is lucrative, but it has price changes during the year hampered by significant. The highest per acre Balochistan reported the highest net returns, followed by Sindh and then Punjab lower returns were reported by Punjabi farmers. Production expenses Punjab had the highest rate than Sindh and Balochistan. Punjabi produce is sold at a lesser price because it is harvested at the height of the season. Sindh and Balochistan have a comparative edge over Punjab in tomato production due to a suitable climate and seasonality. Females are typically in charge of picking, while males are in charge of sorting, packaging, shipping, and marketing. The cost of packaging and transportation is determined by the distance from the market. a lot of seed costs, seeds of poor quality, a scarcity of disease resistant hybrid seed kinds that can withstand extreme climates, the occurrence of a serious pest attacks because of insecticides of poor grade, an insufficient training in technological advancements and labour

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shortages, mainly during harvesting season, were all major production issues mentioned by farmers (Qasim, M. 2018).

The world's most important vegetable crops is the tomato (Solanum Lycopersicon L.) (Arujo et al., 2016). Cherry tomatoes (Solanum Lycopersicon var. Cerasiforme) are a smaller cultivar with more appealing and edible fruits as compared to fresh market tomatoes. It can be consumed raw in sandwiches and salads, cooked, or transformed into ketchup, sauces, liquids, and dried powder. Cherry tomatoes make an important contribution to human nutrition by supplying necessary amino acids, vitamins, and minerals. The crop is strong in vitamin C and lycopene, a powerful antioxidant that aids in the prevention of cancer. Furthermore, the tomato crop is a significant source of revenue for smallholder farmers, particularly women, who sell fresh fruits in regional marketplaces. Because cherry tomatoes have a high nutritional and economic value, growers who want to sell to supermarkets, national, and international markets must boost output while maintaining high quality and production. On the market, cherry tomatoes are more expensive than fresh market tomatoes. Ortas, I. et al. (2013) previously discovered that high potassium levels have an effect on tomato fruit quality (K). Farmers, on the other hand, use little or no potassium (K) fertilizer (El-Bassiony, A. M. 2006), despite the fact that the yield response to nitrogen (N) and potassium (K) fertilizer is critical for optimum plant development and fruit quality in most vegetable crops. In Uganda, cherry tomato growers are no exception; they usually apply little or no fertilizer, reducing productivity and fruit quality. Tomatoes usually absorb a substantial amount of soil nutrients (Ortas, I. 2013). As a result, growers must use Nitrogen and potassium fertilizers to increase nutrient management and fruit output (Ddamulira, G. 2019).

Nitrogen and potassium response yield are also important for plant value in vegetable crops. Farmers frequently use too much or too little fertilizer, reducing plant productivity and quality. Tomatoes are typically grown in fields and greenhouses and fertilized with a range of chemicals. Tomatoes, in general, absorb a lot of nutrients from the soil. Better nitrogen managing has been a major problem for maintainable agricultural in recent years, owing to rising stages of nitrogen in ground water and crops were exposed to high nitrogen fertilizer rates. In order to improve nutrition management, it's critical to employ nitrogen and potassium fertilizers wisely. To improve the quality of fruit output, growers and farmers must regulate fertilizer (Mengel, K., 1980).

High seed prices, low seed value, absence of disease and harsh climate resistant cross seed varieties, the occurrence of severe pest attacks due to low-quality insecticides, absence of good exercise in production skills, and labour lacks, mostly during growing season, were all major production issues mentioned by farmers. All of these findings assisted us in identifying major policy issues that will be thoroughly investigated in the future. The purpose of this study was to investigate “The effects of different fertilization on soil quality and growth of tomato crop (*Lycopersicon esculentum Mill.*)”, while keeping the importance of tomatoes in mind and the lack of fertilizer knowledge.

Materials and Methods

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Description of site

The field study was conceded out at Director Agriculture Research Vegetable Seed Production, ARI Sariab Quetta Balochistan during kharif 2021. The experiment was laid out in a three randomized complete block design (RCBD) having net plot size of 3 x 3m (9m²) in area the distance between PxP is about 1 feet and RxR is 24 inches. The land was prepared by giving two dry ploughings and clod crushing followed by levelling to eradicate the weeds and to make the soil surface for uniform distribution of irrigation water. Six Nitrogen (Urea) and Potassium (SOP) levels including control was examined. All the soil nutrient and crop traits approvals of LUAWMS, Uthal Balochistan. Following in the detail of treatment layout and parameters.

Layout of Work

R1T0	R1T1	R1T2	R1T3	R1T4	R1T5
Water Channel					
R2T1	R2T2	R2T3	R2T4	R2T5	R2T0
Water Channel					
R3T5	R3T4	R3T2	R3T3	R3T0	R3T1

Treatments

Treatments (N and K) = 6

T_0 = Control

T_1 = 50-30 N and K kg ha^{-1}

T_2 = 70-40 N and K kg ha^{-1}

T_3 = 90-50 N and K kg ha^{-1}

T_4 = 110-60 N and K kg ha^{-1}

T_5 = 130-70 N and K kg ha^{-1}

Table 1: Soil physical-chemical properties

Soil characteristics	Unit	Value	Observation
Textural class	-	Silty clay loam	-
pH	-	7.95	Alkaline soil
EC	(dSm^{-1})	1.99	Moderately soil
O.M	(%)	0.67	Organic Matter is low
Total Nitrogen	(%)	0.35	Total Nitrogen is moderate
Available Phosphorus	Mg kg^{-1}	4.05	Available Phosphorus is low
Available Potassium	Mg kg^{-1}	119.7	Available Potassium is low

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Application of fertilizers

In case of fertilizers, nitrogen was practical in the form of urea and potassium in the method of sulphate of potash. A uniform dose of phosphorus (DAP) will also apply in all the plots. 1/3rd of urea along with all SOP will apply at the time of preparation of ridges by mixing in the soil while remaining urea will divide into two equal doses at peak initiation and fruit growth stages with a fortnight interval.

Soil sampling and analysis

After harvesting of crops soil samples was collected from every pot with the assistance of soil auger and placed into plastic bags. Later they was properly labelled. After that soil samples were transferred to the department of soil science at Lasbela University of Agriculture, Water and Marine Sciences in Uthal Baluchistan processed for the analyses of following nutrient availability properties. Soil samples was air dried at room temperature, and sieved with 2mm sieve before being examined for various soil tests. The soil samples was examined for soil pH, electrical conductivity, available phosphorous, available potassium, total nitrogen. The data collect tabularised replication on basis of five casually designated plants in each plot and then averages was worked out. Statistical analysis of the data was done to discriminate the superiority of treatment means, using LSD (Least Significant Differences). The statistical work was performed by using SPSS-19.

Result and Discussion

Result

The field study was carried out at Director Agriculture Research Vegetable Seed Production, ARI Sariab Quetta Balochistan during Kharif 2021. To investigated the "Effects of different fertilization on soil quality and tomato crop (Lycopersicon esculentum mill.)". Six Nitrogen (urea) and potassium (SOP) levels including control were examined. T_0; No fertilizer (Control), T_1; 50-30 NK fertilizers kg ha^{-1}, T_2; 70-40 NK fertilizers kg ha^{-1}, T_3; 90-50 NK fertilizers kg ha^{-1}, T_4; 110-60 NK fertilizers kg ha^{-1}, and T_5; 130-70 NK fertilizers kg ha^{-1}. The soil pH, soil EC (dSm^{-1}), total nitrogen (%), available phosphorus, and available potassium of the tomato soil were calculated, as well as the number of branches plant^{-1}, days to flowering, days to fruiting, number of fruits plant^{-1}, single fruit weight (g), yield plot^{-1} (kg), and yield ha^{-1} (tons). Appendices I-XII present the findings of their analysis of variance, whilst Tables 1.1-1.12 present data on these soil chemical attributes and plant features.

Soil pH

The soil pH is a measure of acidity or alkalinity of the soil, and this can be measured by testing their pH value. Having the correct pH is important for healthy plant growth. Being aware of the long term effects of different soil management practices on soil pH is also important.

Table 2: Shown the soil pH influenced by different levels of NK fertilizers

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Treatment	RI	RII	RIII	Mean
T0	7.63	7.54	7.74	7.6367 C
T1	7.74	7.66	7.92	7.7733 BC
T2	7.76	7.75	7.94	7.8167 B
T3	7.96	7.97	7.97	7.9667 B
T4	7.98	7.97	7.99	7.9800 AB
T5	8.05	8.08	7.98	8.0367 A

According to ANOVA, various concentrations of NK fertilizers had a Significant ($P<0.05$) effect on Soil pH in tomato soil (Appendix-I). Tomato crops served larger amounts of NK fertilizers @130-70 kg ha^{-1} resulted in soil with a higher pH value (8.04), whereas crops fed @110-60, 90-50, and 70-40 kg ha^{-1} NK fertilizers resulted in soil with pH values of 7.98, 7.97, and 7.82, respectively. Soil with the lowest pH (7.77) were reported in the crop soil that got NK fertilizers @50-30 kg ha^{-1}, however soil with the pH (7.64) were identified in control crop that did not receive NK fertilizers. Higher NK fertilizers levels resulted in higher soil pH than lower NK fertilizers levels, and any reduction in NK fertilizers rate less than 130-70 kg ha^{-1} resulted in a slightly decrease in soil pH. This demonstrated that the synthetic application of NK fertilizers resulted in a small reduction in soil pH, which was dose dependent. The soil pH determined in all treatments, however, was within the normal pH range; even a modest fall in soil pH under increased NK fertilizers could be advantageous to soil health. When pH in tomato soils were compared to other treatments and the control, data analysis revealed significant ($P<0.05$) and non-significant ($P>0.05$) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively.

Soil EC (dSm^{-1})

Soil electrical conductivity is a measure of the amount of salts in soil (salinity of soil). It is an excellent indicator of nutrient availability and loss, soil texture, and available water capacity.

Table 3: Shown the soil EC influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean
T0	0.85	0.95	0.84	0.8800 D
T1	1.26	1.25	0.86	1.1233 C
T2	1.28	1.26	1.19	1.2433 BC
T3	1.27	1.27	1.28	1.3067 B
T4	1.38	1.28	1.48	1.3800 AB
T5	1.58	1.46	1.58	1.5400 A

According to the ANOVA, different concentrations of NK fertilizers had significant ($P<0.05$) effect on electrical conductivity in tomato soil (Appendix-II). Tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the

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greatest soil electrical conductivity (1.54 dSm^{-1}), followed by soil with concentrations of 110-60, 90-50, and 70-40 NK fertilizers kg ha^{-1}, which resulted 1.38, 1.31, 1.24. (dSm^{-1}). Soil with the lowest soil electrical conductivity (1.12 dSm^{-1}) were reported in the crop soil that got NK fertilizers @50-30 kg ha^{-1}, however soil with the lowest electrical conductivity (0.88 dSm^{-1}) were identified in control crop that did not receive NK fertilizers. This demonstrated that synthetic nutrients enhanced electrical conductivity in tomato soil and that the increase was dose dependent for NK fertilizers. When electrical conductivity in tomato soils were compared to other treatments and the control, data analysis revealed significant ($P<0.05$) and non-significant ($P>0.05$) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively.

Total Nitrogen (%)

Soil analysis for total nitrogen as effected by NK fertilizers combined application. The analysis showed that applying NK fertilizers raised soil total nitrogen substantially more than the control. The NK fertilizers 130-70 kg ha^{-1} treatment produced the greatest value of 0.42 percent, followed by the NK fertilizers 110-60 kg ha^{-1} treatment. The lowest value was 0.25 percent for the control. The increasing supply of NK fertilizers was employed as a soil supplement for crops, providing significant nutrients to the soil. According to ANOVA, different amount of NK fertilizers had a Significant ($P<0.05$) effect on Total nitrogen (%) in Tomato soil (Appendix-III). Tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the greatest total nitrogen (%) (0.42 %), followed by soil with amounts of 110-60, 90-50, 70-40 NK fertilizers kg ha^{-1}, which resulted 0.41, 0.33, and 0.32 (%). Soil with the lowest total nitrogen (%) (0.28 %) were reported in the crop soil that became NK fertilizers @50-30 kg ha^{-1}, however soil with the lowermost (0.25 %) were identified in Control crop that did not receive NK fertilizers.

Table 4: Shown the total nitrogen as influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean%
T0	0.23	0.25	0.27	0.2500 ^{D}
T1	0.28	0.29	0.28	0.2833 ^{C}
T2	0.32	0.33	0.32	0.3233 ^{BC}
T3	0.34	0.31	0.35	0.3333 ^{B}
T4	0.42	0.39	0.43	0.4133 ^{B}
T5	0.37	0.48	0.42	0.4233 ^{A}

This revealed that synthetic nutrients enhanced total nitrogen (%) in tomato soil and that the increase was dosage dependent for NK fertilizers. When total nitrogen (%) in tomato soils were compared to other treatments and control,

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data analysis revealed significant (P<0.05) and significant (P<0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while NK fertilizers application at 130-70 kg ha^{-1} is uneconomical.

Available phosphorus (mg kg^{-1})

Available phosphorus can be extracted when compared to the Control, the phosphorus content of the soil increased by 130-70 kg ha^{-1} after fruit picking. Phosphorus availability in the soil rose as NK fertilizer application increased, indicating that NK fertilizers promoted insoluble phosphorus solubilization while lowering phosphorus adsorption and fixing in soil.

According to ANOVA, different amount of NK fertilizers had a significant (P<0.05) effect on available phosphorus in tomato soil. (Appendix-IV). Tomato soil with the maximum NK fertilizer content @130-70 kg ha^{-1} had the maximum available phosphorus (4.17), followed by soil with concentrations of 110-60, 90-50, 70-40 kg ha^{-1} NK fertilizers, resulted 4.14, 4.11, 4.077 Mg kg^{-1}. Soil with the availability of phosphorus (4.047) were reported in the crop soil that grown NK fertilizers @50-30 kg ha^{-1}, however soil with the lower most available phosphorus (4.017) were identified in Control crop that did not receive NK fertilizers.

Table 5: Shown the available phosphorus as influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean (mg kg^{-1})
T0	4.03	4.02	4.00	4.0167 ^{F}
T1	4.05	4.04	4.05	4.0467 ^{E}
T2	4.07	4.06	4.10	4.0767 ^{D}
T3	4.09	4.08	4.15	4.1067 ^{C}
T4	4.11	4.10	4.20	4.1367 ^{B}
T5	4.13	4.12	4.25	4.1667 ^{A}

This revealed that synthetic nutrients enhanced available phosphorus in tomato soil and that the increase was amount dependent for NK fertilizers. When available phosphorus in tomato soils were compared to other treatments and control, data analysis revealed significant (P<0.05) and significant (P<0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}.

Available potassium (mg kg^{-1})

The soil's accessible potassium content increased significantly more in NK fertilized treatment plots than in control plots. Tomato soil with the maximum NK fertilizer content @130-70 kg ha^{-1} had the maximum available phosphorus (120.94), followed by soil with concentrations of 110-60, NK fertilizers treatment. The lowest value was 119.61 percent for the control. The increasing supply of NK fertilizers was employed as a soil supplement for crops, providing significant nutrients to the soil. The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while

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NK fertilizers application at 130-70 kg ha^{-1} is uneconomical. According to ANOVA, the different amounts of NK fertilizers had a significant ($P<0.05$) effect on available potassium in tomato soil (Appendix-V).

Table.1.6: Shown the available potassium as influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean (mg kg^{-1})
T0	119.69	119.58	119.56	119.6100 ^{C}
T1	119.72	119.83	119.83	119.7933 ^{C}
T2	119.83	119.72	119.94	119.8300 ^{C}
T3	119.72	120.94	119.72	120.1267 ^{B}
T4	119.94	120.83	120.72	120.4967 ^{AB}
T5	120.38	121.16	121.28	120.9400 ^{A}

Tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the greatest available potassium (120.94) followed by soil with concentrations of 110-60, 90-50, and 70-40 NK fertilizers kg ha^{-1}, resulted 120.50, 120.12, 119.83 mg kg^{-1}. Soil with the lowest available potassium (119.79) were reported in the crop soil that got NK fertilizers @50-30 kg ha^{-1}, however soil with the lowest (119.61) were identified in control crop that did not receive NK fertilizers. This revealed that synthetic nutrients enhanced available potassium in tomato soil and that the increase was dose dependent for NK fertilizers. When available potassium in tomato soils were compared to other treatments and the control, data analysis revealed significant ($P<0.05$) and non-significant ($P>0.05$) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while NK fertilizers application at 130-70 kg ha^{-1} is uneconomical.

Number of branches plant^{-1}

Number of branches plant^{-1} is an important quality in tomatoes since the more branches on a plant, the more fruits plant^{-1} will generate. Tomato branching varies per variety, although it is mostly determined by ecological issues and the amount of nutrients provided to the tomato plant. An ANOVA study of the degree of treatment effects revealed that varied rates of NK fertilizers had a significant effect on the number of branches plant^{-1} ($P<0.05$) (Appendix-VI).

Table 7: Variable concentrations of NK fertilizers as shown, affect the number of branches plant^{-1}

Treatments	RI	RII	RIII	Means
T0	3.00	4.00	5.00	4.0000 ^{C}
T1	3.00	5.00	4.00	4.0000 ^{C}
T2	4.00	4.00	5.00	4.3333 ^{B}
T3	4.00	5.00	5.00	4.6667 ^{AB}
T4	5.00	6.00	6.00	5.6667 ^{A}
T5	6.00	6.00	5.00	5.6667 ^{A}

According to Table-1.7, fertilization of tomato with NK fertilizers levels of 130-70 kg ha^{-1} resulted in the maximum average number of branches Plant^{-1} (5.67), followed by tomato crops fertilized with NK fertilizers at rates of 110-60, 90-50, and 70-40 kg ha^{-1}, which resulted in 5.67, 4.67, and 4.33, respectively. The results for The Number of branches plant^{-1} demonstrate that greater NK fertilizers levels resulted in more branches plant^{-1}, while lower NK fertilizers levels led in a decrease in tomato branching. The recommended that the investigational soil lacked appropriate nitrogen ratio and accessible potassium, and that when synthetic nitrogen and potassium were given to the plants at increased the rates, the plants responded positively. The Number of branches plant^{-1} rose dramatically as a result of the soil. The number of branches plant^{-1} (4.00) were reported in the crop soil that grown NK fertilizers @50-30 kg ha^{-1}, however soil with the lower most number of branches plant^{-1} (4.00) were identified in control crop that did not receive NK fertilizers. When compared to the other treatments, including the control, the difference in number of branches plant^{-1} between NK fertilizers dozes of 130-70 kg and 110-60 kg h^{-1}, 90-50 kg and 70-40 kg ha^{-1}, was statistically non-significant (P>0.05). According to the findings of this study, 110-60 kg NK ha^{-1} is significant (<0.05). The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while NK fertilizers application at 130-70 kg ha^{-1} is uneconomical.

Days to flowering

The number of days it takes for a tomato plant to flower is a physical quality that can be impacted by the biological makeup of each parental material; however, soil fertility and the usage of synthetic fertilizer may have a bigger influence on this attribute.

According to the ANOVA uncovered (Appendix-VII) the days to flowering of the tomato to flower. Days to flowering was considerably impacted by the concentrations of compound nitrogen and potassium fertilizers (P<0.05). According to Table-1.8, fertilization of tomato with NK fertilizers levels of 130-70 kg ha^{-1} resulted in the maximum average days to flowering (49.33), followed by tomato crops fertilized with NK fertilizers at rates of 110-60, 90-50, and 70-40 kg ha^{-1} flowered the slowest (49.33 days) followed by tomato crops fertilized at rates of 48.00, and 46.67 days respectively. The crop had the lowest time to flower (46.00 days) when planted with NK fertilizers @50-30 NK fertilizers kg ha^{-1}, whereas control plots by no NK fertilizers took the less days (44.33).

Table 8: Shown as days to flowering is influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean
T0	45.0	46.0	42.0	44.3333 ^{C}
T1	46.0	48.0	44.0	46.0000 ^{BC}
T2	47.0	47.0	46.0	46.6667 ^{BC}
T3	48.0	48.0	48.0	48.0000 ^{AB}
T4	49.0	49.0	50.0	49.3333 ^{A}
T5	50.0	48.0	50.0	49.3333 ^{A}

The days to flowering data demonstrated that crops with higher NK fertilizers levels took longer days to flowering and that crops flowered earlier as NK fertilizer were reduced. This meant that the experimental soil was low in NK fertilizers, and that when higher rates of synthetic NK fertilizers were applied to

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the soil, the plants responded positively, allowing for a normal physiological flowering period. Inadequate NK fertilizers availability from the soil to the plant, on the other hand, resulted in the plant flowering prematurely and missing the crop's natural growth phase. When NK fertilizers doses of 11-60, 90-50, 70-40, and 50-30 kg ha^{-1} were utilized in contrast to the other treatments and the control, differences in days to flowering in tomato were non-significant ($P>0.05$). According to the findings of this study, the ideal amount of NK fertilizers ha^{-1} for tomato to generate a healthy growth phase was 130-70 NK fertilizers kg ha^{-1}. The study's findings indicate that the best amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while NK fertilizers application at 130-70 kg ha^{-1} is uneconomical.

Days to fruiting

The number of days it takes for fruiting is a physiological property that is normally influenced by genetics; but, with tomatoes, the amount of fertilizer applied may have a major influence on this parameter. The amount of NK fertilizers applied had a significant result on the days to fruiting of the tomato based on ANOVA ($P<0.05$) (Appendix-VIII). According to Table-1.9, fertilization of tomato with NK fertilizers levels of 130-70 kg ha^{-1} resulted in the maximum average days to fruiting (55.00), followed by tomato crops fertilized with NK fertilizers at rates of 110-60, 90-50, and 70-40 kg ha^{-1} flowered the slowest (54.67 days) followed by tomato crops fertilized at rates of 53.33, and 52.33 days respectively.

Table1.9: Shown as days to fruiting is influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean
T0	50	50	48	49.3333 ^{C}
T1	52	52	51	51.6667 ^{B}
T2	51	53	53	52.3333 ^{B}
T3	53	52	55	53.3333 ^{AB}
T4	55	53	56	54.6667 ^{A}
T5	55	54	56	55.0000 ^{A}

The crop fed 50-30 kg ha^{-1} N-K fertilizer grew in fewer days (51.67) than the control plots that were not treated (49.33). The number of days to fruit growth data demonstrate that crops with greater NK fertilizers levels began fruit growth later than crops with lower NK fertilizers levels, and that crops began fruit growth earlier when NK fertilizer levels exceeded 130-70 NK fertilizers kg ha^{-1}. Data on days to fruit growth demonstrate that crops with greater NK fertilizers levels ripened later than crops with lower NK fertilizers levels, and crops ripened earlier as NK fertilizer levels increased (130-70 kg ha^{-1}). When compared to the other treatments, including the control, the difference in days to fruiting between NK fertilizers dozes of 130-70 kg and 110-60 kg h^{-1}, 90-50 kg and 70-40 kg ha^{-1}, was statistically non-significant ($P>0.05$). The optimal level of NK fertilizer ha^{-1} for tomato in terms of days to fruit growth, according to the results of this study, was 110-60 NK fertilizers kg ha^{-1}. The study's findings indicate that the best

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amount of NK fertilizers treatments for tomato is 110-60 fertilizers kg ha^{-1}, while NK fertilizers application at 130-70 kg ha^{-1} is uneconomical.

Number of fruit plant^{-1}

The number of fruit plant^{-1} is a component of tomato crop production that is heavily influenced by the crop variety's adaptation to a certain habitat as well as the level of critical nutrients in the cropping soil.

Table.1.10: As shown number of fruit plant^{-1} as influenced differing amount of NK fertilizers

Treatment	RI	RII	RIII	Mean
To	43	36	38	39.0000 ^{C}
T1	43	38	40	40.3333 ^{C}
T2	44	41	41	42.0000 ^{BC}
T3	46	46	43	45.0000 ^{AB}
T4	48	48	48	48.0000 ^{A}
T5	46	50	49	48.3333 ^{A}

The ANOVA (Appendix-IX) demonstrated that different levels of NK fertilizer had a significant impact on tomato fruit plant^{-1} quantity ($P<0.05$). Tomato crops fertilized at 130-70 kg ha^{-1} yielded the most fruits plant^{-1} (48.33), followed by crops treated at 110-60, 90-50, and 70-40 kg ha^{-1}, yielding 48.00, 45.00, and 42.00, respectively. The experimental tomato was NK fertilized at rate of 50-30 kg ha^{-1}, resulting in less fruits plant^{-1} (40.33), while the higher days to fruiting (39.00) in control which less higher number of fruit plant^{-1}. Crop yields increased when NK fertilizers rates increased to 130-70 kg ha^{-1}, and plants with greater NK fertilizers levels produced 48.00 more fruits plant^{-1} than plants with lower NK fertilizers levels. Crops with average NK fertilizer levels produced more fruits plant^{-1} on higher than crops with lower NK fertilizer levels, and any increase in NK fertilizer rate greater than 130-70 kg NK fertilizer ha^{-1} resulted in a reduction in crop number of fruit plant^{-1}. This meant that the experimental soil required NK fertilizers, and that supplying these nutrients had a positive effect. Number of fruit plant^{-1} also produced less fruits as a result of soil NK fertilizers deficiencies. According to data analysis, the differences in the number of fruits plant^{-1} in the tomato were significant ($P<0.05$) and significant ($P>0.01$) at NK fertilizer levels of 130-70 kg ha^{-1} and 110-60 kg ha^{-1}, respectively (P0.05). Increasing the quantity of fruits plant^{-1} by spraying NK fertilizers @130-70 kg ha^{-1} NK fertilizers was thus not costly. This revealed that using of NK fertilizers to increase the number of fruits plant^{-1} @130-70 kg ha^{-1} was in efficient; thus, 110-60 kg ha^{-1} NK fertilizers would suffice.

Single fruit weight (g)

Among the most important factors that impacts final yield is the single fruit weight, which is mostly governed by a variety's genetic composition. Nutrients that are necessary for plant growth and fruit development, on the other hand, have a greater impact.

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Table.1.11: Shown as single fruit weight (g) is influenced by different levels of NK fertilizers (g)

Treatment	RI	RII	RIII	Mean
To	49.2	49.2	42.8	47.0667 B
T1	51.2	49.7	44.4	48.4333 B
T2	53.2	50.2	46.1	49.8333 B
T3	55.3	51.7	43.2	50.0667 B
T4	58.4	54.8	50	54.4000 A
T5	59.5	55.2	55	56.5667 A

Different NK fertilizer levels exhibited a significant effect on the single fruit weight (g) tomato crop products, according to the ANOVA ($P<0.05$) (Appendix-X). Tomato crops grown with the greatest NK fertilizer (130-70 kg ha^{-1}) produced the largest single fruit weight (56.57 g), followed by crops grown with the least NK fertilizer (110-60, 90-50 and 70-40 kg ha^{-1}) producing 54.40, 50.07, and 49.83 g, respectively. While the experimental tomato crop had a lower single fruit weight (48.43 g) in the control plots with no NK fertilizers, it was fed NK fertilizers @50-30 kg ha^{-1}, resulting in a lower single fruit weight (47.07 g) in the no NK fertilizer served plots. It was also discovered that crops given greater NK fertilizers levels produced higher fruits than those given lower NK fertilizers levels, and that the fruits decreased quantitatively each time the NK fertilizers rate reduced by more than 130-70 kg ha^{-1} NK fertilizers. This indicated that the trial soil was low in NK fertilizers and that it reacted favourable to these nutrients at greater concentrations; the soil deficiency reduced single fruit weight. When these treatment sets were combined with the other treatments and the control, data analysis demonstrated that differences in single fruit weight in tomato were significant ($P<0.05$) and non-significant ($P>0.05$) at NK fertilizer levels of 130-70 and 110-60 kg ha^{-1}, or 90-50 and 70-40 kg ha^{-1}, respectively ($P>0.05$). NK fertilizers with ppm concentrations ranging from 130-70 NK fertilizers are recommended based on these findings. Based on this data, it was determined that increasing weight of single fruit with NK fertilizers at a rate of 130-70 kg ha^{-1} was not cost-effective; thus, 110-60 kg NK ha^{-1} was chosen as an adequate amount for this characteristic.

Yield plot^{-1} (kg)

Plant height, number of branches plant^{-1}, number of fruits plant^{-1}, and weight of single fruit all have an impact on fruit yield. The obtainability of critical elements in the soil has the greatest influence on yield, however the genetic mix of the cultivars can also have an impact. Nutrients, on the other hand, have a much greater impact on fruit yield. According to the ANOVA, increasing the amount of NK fertilizers had a significant impact on tomato fruit yield plot^{-1} ($P<0.05$) (Appendix-XI). The tomato crop with the highest NK fertilizers (13-70 kg ha^{-1}) produced the most fruit plot^{-1} (14.20), trailed by crops with 110-60, 90-50, and 70-40 kg ha^{-1} of NK fertilizers, which produced 13.30, 12.87, and 11.97 kg fruit, respectively.

Table.1.12: Shown as result of various NK fertilizers levels on yield plot^{-1} (kg)

Treatment	RI	RII	RIII	Mean
To	8.8	8.2	9.8	8.9333 ^{E}
T1	9.8	9.8	11.9	10.500 ^{D}
T2	10.5	12.5	12.9	11.967 ^{C}
T3	11.8	12.9	13.9	12.867 ^{B}
T4	12.2	13.4	14.3	13.300 ^{B}
T5	13.8	13.6	15.2	14.200 ^{A}

Fruit yield plot^{-1} was lower (10.50) when NK fertilisers were added to the experimental tomato @50-30 kg ha^{-1}, while the lowest fruit yield plot^{-1} (8.93) was obtained in control plots with no NK fertilizers applied. When compared to the other treatments, including the control, the difference in single fruit weight between NK fertilizers dozes of 130-70, and 110-60, 90-50, and 70-40 kg ha^{-1}, was statistically significant ($P<0.05$). Based on these findings, The NK fertilizers of 130-70 kg ha^{-1} NK fertilizers were found to be ineffectual for improving fruit production plot kg ha^{-1} when compared to 110-60 kg ha^{-1} NK fertilizers; hence, 110-60 kg ha^{-1} NK fertilizers was chosen as the optimal amount for economically growing higher tomato yields.

Yield ha^{-1} (tons)

Fruit yield ha^{-1} is calculated by adding fruit plot kg ha^{-1}, plant height, plant number, and plant number together.

Table 13: Shown as yield ha^{-1} (tons) is influenced by different levels of NK fertilizers

Treatment	RI	RII	RIII	Mean
To	12.3	12.5	12.3	12.3667 ^{C}
T1	12.8	12.8	12.9	12.8333 ^{BC}
T2	13.4	13.5	13.8	13.5667 ^{AB}
T3	13.6	14.3	14.3	14.0667 ^{AB}
T4	14.2	15.5	15.7	15.1333 ^{A}
T5	14.5	15.8	15.3	15.2000 ^{A}

The ANOVA (Appendix-XII) revealed that varied NK fertilizers amounts had a Significant effect on fruit yield ha^{-1} ($P<0.05$). The crop that received the most NK fertilizers (130-70 kg ha^{-1}) yielded the most fruit ha^{-1} (15.20 tons), followed by crops that received 110-60, 90-50, and 70-40 kg ha^{-1} NK fertilizers, which yielded 15.13, 14.06, and 13.57 tons, respectively. The crop that got 50-30 kg ha^{-1} NK fertilizers yielded fewer fruit ha^{-1} (12.83 tons), whereas control plots yielded the least fruit ha^{-1} (12.37 tons). Higher fruit ha^{-1} was mostly due to more branches plant^{-1}, more fruits plant^{-1}, and improved fruit weight, all of which resulted in a higher fruit yield ha^{-1} when compared to tomato fertilized with minimal NK fertilizers levels. The rate of NK fertilizer was increased from 130-70 NK fertilizers kg ha^{-1}, leading in a considerable fall in fruit yield ha^{-1}. The increase in tomato fruit yield ha^{-1} was Significant ($P<0.05$) for NK fertilizers values of 130-70

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and 110-60 kg ha^{-1}, but non-significant (P>0.05) for NK fertilizer values of 90-50 and 70-40 kg ha^{-1}, respectively. As a consequence, 110-60 NK fertilizer kg ha^{-1} was judged to be the most cost-effective amount for increasing tomato yields.

Table 14: LSD of various treatments

T	**5**	**4**	**3**	**2**	**1**	**0**
PH	8.0367 A	7.9800 A	7.9667 A	7.8167 B	7.7733 B	7.6367 C
EC	1.5400 A	1.3800 A	1.3067 BC	1.2433 BC	1.1233 C	0.8800 D
N %	0.4233 A	0.413 A	0.3333 B	0.3233 B	0.2833 BC	0.2500 C
P	4.1667 A	4.1367 AB	4.1067 BC	4.0767 CD	4.0467 DE	4.0167 E
K	120.94 A	120.50 AB	120.13 BC	119.83 C	119.79 C	119.61 C
NBP	5.6667 A	5.6667 A	4.6667 AB	4.3333 B	4.0000 B	4.0000 B
Df	49.333 A	49.333 A	48.000 AB	46.667 BC	46.000 BC	44.333 C
DF	55.000 A	54.667 A	53.333 AB	52.3333 B	51.667 B	49.333 C
NFP	48.333 A	48.000 A	45.000 AB	42.000 B C	40.333 C	39.000 C
WS P	56.567 A	54.4000 A	50.0667 B	49.8333 B	48.433 B	47.067 B
YP	15.200 A	15.133 AB	14.067 B	13.567 B	12.833 C	12.367 C
YH	15.200 A	15.133 A	14.067 B	13.067 B	12.833 C	12.367 C

Discussion

The purpose of the study was "Effects of different fertilization on soil quality and tomato crop (*Lycopersicon esculentum mill.*) during the Kharif 2021 growing season. The nitrogen (N) and potassium (K) treatments were T_0; no fertilizer (control), T_1; 50-30 NK fertilizers kg ha^{-1}, T_2; 70-40 NK fertilizers kg ha^{-1}, T_3; 90-50 NK fertilizer kg ha^{-1}, T_4; 110-60 NK fertilizer kg ha^{-1}, and T_5; 130-70 NK fertilizer kg ha^{-1}. The soil pH, soil EC (dSm^{-1}), total Nitrogen (%), available phosphorus, and available potassium of the tomato soil were calculated, as well as the number of branches plant^{-1}, days to flowering, days to fruiting, number of fruits plant^{-1}, single fruit weight (g), yield plot^{-1} (kg), and yield ha^{-1} (tons), were all calculated. Crops fed more NK fertilizer @130-70 kg ha^{-1} produced soil with a higher pH (8.04), whereas crops fed less NK fertilizer @110-60, 90-50, and 70-40, produced soil with pH values of 7.98, 7.96, and 7.82, soil with the lower soil pH (7.77) were identified in NK fertilizer @50-30 kg ha^{-1} however soil with the most lowest soil pH (7.64) were recognized in control crop that did not receive

NK fertilizers respectively. Higher NK fertilizer rates resulted in higher soil pH than lower NK fertilizer rates, and every increase in NK fertilizer level above 130-70 kg ha^{-1} NK fertilizer resulted in a modest increase in soil pH. This demonstrated that the synthesized treatment of NK fertilizers resulted in a small increase in soil pH, which was dose sensitive. When pH in tomato soils were compared to other treatments and the control, data analysis revealed significant ($P<0.05$) and non-significant ($P>0.05$) differences in NK fertilizer levels of 130-70, 110-60, and 90-50 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The results are in agreement with those of Ahmed, J. et al. 2021 reported that the pH levels of soil increased when the NK fertilizers levels increased. While, tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the greatest electrical conductivity (dSm^{-1}) (1.54), followed by soil with concentrations of 110-60, 90-50, and 70-40 NK fertilizers kg ha^{-1} , which resulted 1.38, 1.31, 1.24 (dSm^{-1}). Soil with the lower electrical conductivity (1.12) were reported in the crop soil that got NK fertilizers @50-30 kg ha^{-1} , however soil with the lowest soil EC (0.88 dSm^{-1}) were identified in control crop that did not receive NK fertilizers. When soil EC in tomato soils were compared to other treatments and the control, data analysis revealed significant ($P<0.05$) and significant ($P<0.05$) differences in NK fertilizers levels of 130-70 and 110-60 kg ha^{-1} of NK fertilizers or 70-40 and 50-30 kg ha^{-1} NK fertilizers respectively. The studies carried out by Ahmed, J. et al. 2021 reported that soil EC levels increased when the NK fertilizers levels increased. Though, soil total nitrogen substantially more than the control. Tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the greatest total nitrogen (%) (0.42), followed by soil with amounts of 110-60, 90-50, 70-40 NK fertilizers kg ha^{-1}, which resulted 0.41, 0.33, and 0.32 (%). Soil with the lower total nitrogen (%) (0.28 %) were reported in the crop soil that became NK fertilizers @50-30 kg ha^{-1}, however soil with the lowermost (0.25 %) were identified in control crop that did not receive NK fertilizers. This revealed that synthetic nutrients enhanced total nitrogen (%) in tomato soil and that the increase was dosage dependent for NK fertilizers. When total nitrogen (%) in tomato soils were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and non-significant ($P>0.05$) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The increasing supply of NK fertilizers was employed as a soil supplement for crops, providing significant nutrients to the soil. The results regarding by Ahmed, J. et al. 2021 reported that soil total nitrogen levels increased when the NK fertilizers levels increased. Although, the available phosphorus content of the soil after fruit picking by 130-70 kg ha^{-1}, respectively, when compared to the control. Tomato soil with the highest NK fertilizer content @130-70 kg ha^{-1} had the greatest available phosphorus (4.17 mg kg^{-1}), followed by soil with amounts of 110-60, 90-50, 70-40 NK fertilizers kg ha^{-1}, which resulted 4.14, 4.11, and 4.077 mg kg^{-1}. Soil with the lower available phosphorus (4.047) were reported in the crop soil that became NK fertilizers @50-30 kg ha^{-1}, however soil with the lowermost (4.017) were identified in Control crop that did not receive NK fertilizers. This revealed that synthetic nutrients enhanced available phosphorus in tomato soil and that the increase was dosage dependent for NK fertilizers. When available phosphorus in tomato soils were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and significant (<0.05) differences in NK

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fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. These results are in accordance with those of Ahmed, J. et al. 2021 reported that soil available phosphorus levels increased when the NK fertilizers levels increased.

Whereas, available potassium content grew much more than the control plot's. The potassium content of fruits after they have been picked. The treatment that received NK fertilizers ranging from @130-70 kg ha^{-1} had the greatest potassium value of 120.94 mg kg^{-1} followed by soil with amounts of 110-60, 90-50, 70-40 NK fertilizers kg ha^{-1}, which resulted 120.50, 120.13, and 119.83 Mg kg^{-1}. Soil with the lower available potassium (119.79) were reported in the crop soil that became NK fertilizers @50-30 kg ha^{-1}, however soil with the lowermost (119.61) were identified in control crop that did not receive NK fertilizers. When available potassium in tomato soils were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and non-significant (>0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The results are in agreement with those of Ahmed, J. et al. 2021 the available potassium in the soil was also increased according to the levels of K added.

However, number of branches $plant^{-1}$ in tomato may vary variety to variety, but the branching is mainly guided by the environmental factors and quantities of nutrients being supplied to the crop. NK fertilizers levels of 130-70 kg ha^{-1} produced highest number of branches $plant^{-1}$ (5.67) on average, followed by NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} with 5.67, 4.67 and 4.33 average number of branches $plant^{-1}$ respectively. The number of branches $plant^{-1}$ the lowest (4.00), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (4.00) were identified in control crop that did not received NK fertilizers. It can be seen from the results regarding the number of branches $plant^{-1}$ that the higher NK fertilizers levels resulted in more number of branches $plant^{-1}$; and with each curtailment in the level of NK fertilizers resulted in a simultaneous decline in the branching in tomatoes. This suggested that the experimental soil was deficient of nitrogen percentage and available potash and responded appreciably to increase the number of branches $plant^{-1}$ when synthetic NK fertilizers were supplied to the plants through soil at higher rates. When number of branches $plant^{-1}$ in tomato plant were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and non-significant (>0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The results are in agreement with those of Nwadukwe, P. O et al. (1994), Deek, J. M., *et al.* (1997) and Fapohunda, H. O. (1992) who were of the opinion that increasing of NK fertilizers are essential for proper plant growth of tomato and flowering to produce quality fruits. Days to flowering crop fertilized with NK fertilizers levels of 130-70 kg ha^{-1} took maximum days to flowering (49.33) on average; followed by the tomato crop supplied with NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} taking 49.33, 48.00 and 46.67 days to flowering, respectively. The days to flowering the lowest (46.00), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (44.33) were identified in control crop that did not received NK fertilizers. The higher NK fertilizers levels took more days to flowering; and with each shortening of NK fertilizers, the crop showed earliness in flowering. This

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suggested that the experimental soil was inadequate of NK fertilizers and responded appreciably to avail proper physiological period for flowering when synthetic NK fertilizers were supplied to the plants through soil at higher rates. When days to flowering in tomato soils were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and non-significant (>0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. On the other hand, in case of inadequate availability of NK fertilizers from the soil to the plant resulted in reaching early to the flowering stage without availing the growth period required by the crop naturally. Similar results have also been reported by Deek, J. M., *et al*. (1997) who reported that higher fertilizer levels delayed the flowering tomato, while Fapohunda, H. O. (1992) and Maboko, M. M. (2005) who reported that increase in the nitrogen and potash proportionately increased the days to flowering.

Days to fruiting The tomato synthetically fertilized with NK fertilizers @130-70 kg ha^{-1} took more days to fruiting (55.00) on average; followed by the tomato crop supplied with NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} taking 54.67, 53.33 and 52.33 days to fruit development, respectively. The days to fruiting the lowest (51.67), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (49.33) were identified in control crop that did not received NK fertilizers. The number of days to fruit development that the crop supplied with higher NK fertilizers levels started fruit development later than that given lower NK fertilizers levels; and with each shortening of NK fertilizers over 130-70 kg ha^{-1}, the crop experienced an earliness in fruit development. This suggested that the experimental soil was inadequate of NK fertilizers and responded positively to avail its natural physiological period for fruit development when NK fertilizers were supplied synthetically through soil at higher rates. Moreover, in case of inadequate availability of NK fertilizers in experimental soil, the plants reduced their growth period reaching early to the fruit development stage. When days to fruiting in tomato soils were compared to other treatments and control, data analysis revealed significant ($P<0.05$) and significant ($P>0.05$) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The studies carried out by Nwadukwe, P. O et al. (1994), Shedeed, S. I. *et al*. (2009) and Mengel, K. et al. (1980) also showed similarity with the findings of the present study and reported that higher rates of nitrogen and potash fertilizers increasing the fruiting development in tomatoes.

Number of fruits plant^{-1} tomato crop supplied with NK fertilizers @130-70 kg ha^{-1} produced more number of fruits plant^{-1} (48.33) on average; followed by the crop supplied with NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} producing 48.00, 45.00 and 42.00 numbers of fruits plant^{-1}, respectively. The number of fruits plant^{-1} the lowest (40.33), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (39.00) were identified in control crop that did not received NK fertilizers. The crop supplied with higher NK fertilizers levels produced more fruits on average plant^{-1} than that of given lower NK fertilizers levels; and with each decrease in NK fertilizers rate over 110-60 kg ha^{-1}, the crop experienced reduction in its number of fruits plant^{-1}. This showed that the experimental soil was inadequate of NK fertilizers and responded positively to these nutrients at higher levels. Moreover, due to soil deficiency of

NK fertilizers, lower number of fruits plant^{-1} was developed. When number of fruit plant^{-1} in tomato soils were compared to other treatments and control, data analysis revealed significant (P<0.05) and non-significant (>0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. The results regarding the fruits plant^{-1} achieved in the present study are in agreement with those of (Shedeed, S. I., 2009), (Mengel, K., 1980) and (Nanadal, J. K., 1998) who reported that higher fruits number on average plant was associated with the higher rates of nitrogen, phosphorus and potash fertilizers; and the fruits number plant^{-1} were dose dependent so far these nutrients are related. Single fruit weight (g) the tomato crop supplied with highest level of NK fertilizers (130-70 kg ha^{-1}) resulted in more weight of single fruit on average (56.57 g); followed by the crop supplied with NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} producing 54.40, 50,06 and 49.83 g of single fruits weight, respectively. The single fruit weight the lowest (48.43), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (47.06) were identified in control crop that did not received NK fertilizers. The crop given higher NK fertilizers levels produced heavier fruits than that of supplied with lower NK fertilizers levels; and with each decrease in NK fertilizers rate over 130-70 kg ha^{-1}, the fruits were deteriorated quantitatively. When single fruit weight in tomato soils were compared to other treatments and control, data analysis revealed significant (P<0.05) and non-significant (>0.05) differences in NK fertilizer levels of 130-70 and 110-60 NK fertilizers kg ha^{-1}, or 70-40 and 50-30 NK fertilizers kg ha^{-1}, respectively. These results are in accordance with those of (Nanadal, J. K., 1998), Altunlu, H., *et al.* (1997) and Ortas, I., *et al.* (1999) who were of the experience that increase in the fertility levels produced heavier fruits on average.

Yield plot^{-1} (kg) the crop that received the most NK fertilizers (130-70 kg ha^{-1}) produced the most fruit (14.20 kg), followed by crops that received 110-60, 90-50, and 70-40 kg ha^{-1} of NK fertilizers, which produced 13.30, 12.87, and 11.97 kg ha^{-1}, respectively. The yield plot^{-1} the lowest (10.5), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (8.93) were identified in control crop that did not received NK fertilizers. The NK fertilizers application rate was reduced from 130-70 kg ha^{-1}, resulting in a significant (<0.05) fall in fruit yield plot^{-1}. Differences in tomato fruit yield plot^{-1} at NK fertilizers levels of 130-70 and 110-60 kg ha^{-1}, 90-50 and 70-40 kg ha^{-1}, were not statistically significant (P>0.05) (P0.05). As a consequence, the amount of NK fertilizers 110-60 kg ha^{-1} found to be the most cost-effective for increasing tomato yields was 110-60 kg ha^{-1}. These results are in line with those of Al-Karaki, G. N. (2000), El-Bassiony, A. M. (2006), Zhao-Hui, L. I. U. et al. (2008), Huang, J et al. (2009), Akhtar, M. E et al. (2010), Manoj, K., et al. (2013) and Ortas, I. (2013) who reported that the fruit yield in tomato is directly proportional to application of synthetic fertilizers and quantitative the yields were dose dependent. Yield ha^{-1} (tons) The crop given with highest level of NK fertilizers (130-70 kg ha^{-1}) produced highest fruit yield ha^{-1} (15.20 tons); followed by the crop supplied with NK fertilizers @110-60, 90-50 and 70-40 kg ha^{-1} producing 15.13, 14.07 and 13.57 tons fruit yield ha^{-1}, respectively. The yield ha^{-1} (tons) the lowest (12.83), were reported in the crop that became NK fertilizers @50-30 kg ha^{-1}, however plant with lowermost (12.36) were identified in control crop that did not received NK fertilizers. This higher fruit yield ha^{-1} in tomato fertilized with higher NK

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fertilizers levels was mainly associated with more branches plant^{-1}, more fruits plant^{-1}, higher single fruit weight than that of supplied with lower NK fertilizers levels; which accumulated to produce higher fruit yield ha^{-1}. With each decrease in NK fertilizers rate over 130-70 kg ha^{-1}, the fruit yield ha^{-1} was declined considerably. However, the statistical analysis showed that the differences in fruit yield ha^{-1} in tomato under NK fertilizers levels of 130-70 and 110-60 kg ha^{-1} or between 90-50 and 70-40 kg ha^{-1} were significant ($P<0.05$) and non-significant ($P>0.05$) when these treatments groups were compared with each other and with rest of the treatments as well as control. Hence, NK fertilizers @110-60 kg ha^{-1} was considered to be an optimum level for producing economically higher yields in tomato. These results are in line with those of Al-Karaki, G. N. (2000), El-Bassiony, A. M. (2006), Zhao-Hui, L. I. U. et al. (2008), Huang, J et al. (2009), Akhtar, M. E et al. (2010), Manoj, K., et al. (2013) and Ortas, I. (2013) who reported that the fruit yield in tomato is directly proportional to application of synthetic fertilizers and quantitative the yields were dose dependent.

Conclusions

The current study's findings could lead to the following conclusions: The combined application of nitrogen and potassium fertilizers @130-70 kg ha^{-1} increased soil quality, tomato fruit yield and quality significantly. The soil pH, soil EC, total nitrogen %, available phosphorus, available potassium contents. Tomato crops fertilized with NK fertilizers @130-70 kg ha^{-1} grew and yielded higher quality than crops fertilized with a lower NK fertilizers @110-60 kg ha^{-1}, despite the fact that the differences in quantitative and qualitative were not statistically significant. As a significance, an optimum amount of NK fertilizers @110-60 kg ha^{-1} for economically increased soil quality and tomato fruit yields was determined.

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