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Effect of different soil pHs and potassium and phosphorous concentrations on quantitative and qualitative characteristics of Tomato fruit (*Lycopersicom esculentum* c.v Calji)

Maasumeh Hojhabrian

Department of Horticulture, Islamic Azad University of Jahrom, Iran.

ABSTRACT

In order to evaluate the effect of soil pH , phosphorous and potassium element on growth and yield of tomato plant (Lycopersicom esculentum c.v Calji) in soil culturing, was conducted an experiment as factorial arrangement in completely randomized design with three replications. The first factor was including different soil pHs (6, 7, 8) and the second factor was consisting phosphorous and potassium fertilizers(0, 40 and 80 mg P Kg^{-1} soil) in the form triple super phosphate, Potassium nitrate was used as. . To provide nitrogen, 200 mgKg^{-1} urea was equally used to the plants. Then the traits of flower number, fruit number, plant yield, vitamin C, and TSS and chlorophyll index were recorded. . Factors, the number of flowers. Total fruit and plant chlorophyll were recorded Experimental results showed that the highest number of goals in the levels of potassium and phosphorus were observed at 6 and Edge and the least number of flowers in the levels of potassium and phosphorus were observed Edge 8. 40 mg kg potassium and phosphorus in the soil was observed at pH 6 in Chlorophyll lowest levels of 40 mg per kg of soil phosphorus and potassium was observed.

Keywords: tomatoes, urea, potassium, phosphorus, pH soil.

INTRODUCTION

Tomato (*Lycopersicom esculentum* L.) is one of the flowering higher plants from dicotyledonous order and Solanaceae family. This plant is native to Central and South America, which during the Spanish colonial period were transferred to other parts of the world [4]. Nowadays, different type of this plant is grown throughout the world. Tomato is rich in vitamin C and Lycopene [4]. Tomatoes are rich in vitamins A, B and C, iron, phosphorus and boron minerals are particularly abundant. Potassium is another mineral essential elements needed by the plants that most soils except sandy soil potassium reserves ratio as a whole. Most plants absorb large amounts of potassium and potassium uptake by plants is higher than all other nutrients except nitrogen. Desirable when the leaves are about 2% of the value of 1/5 percent less likely to develop symptoms into strips at the edges and margins of the leaves are purple. Potassium activates enzymes are also involved in protein synthesis Dardvdr potassium deficiency and accumulation of amino acids, soluble sugars are soluble in concentrated nitric acid have the hope and the role of potassium in protein synthesis. Potassium is a plant resistance against dehydration and hypothermia. Potassium is the major cation which neutralizes the electrical charge of anions in chloroplasts Cytoplasm to reduce nitrate accumulation in vegetables and Jat is Shvdbas. Green spot disease (green tomatoes at the end) that is insipid and tasteless, is due to potassium deficiency. Another indicator of the pH of the nutrient uptake is an indicator of acidity and play on medium plants and chemical characteristics, physical and biological soil properties is effective [13].

Phosphate concentration in the root is about 100-1000 times the concentration of phosphate in the soil solution. Small part of P also is converting to organic compounds in the plant that are consisting: phospholipids, phosphorous sugar, DNA, ADP and ATP, which are energy carrier. Phosphorous led to roots growth. Phosphorous is causing to early ripening and enhancement of generative growth and in the fruit trees is leading to fruit early ripening and improvement of fruits and vegetables quality [5]. pH is one of the other effective factors for uptake of nutrient elements, which it is acidity and alkalinity index in plant culture medium and is effective on soil chemical, physical and biological properties [10]. The study was conducted in Vertisol pellic of phosphorus fertilizer on tomato and eggplant used as fertilizer, irrigation and fertilizer P from triple super phosphate sources were used to prepare and test results showed that the yield increases when FERTIGATION phosphorus fertilizer to be used. Shalmani Mousavi *et al* [15] experiment in Agricultural Research and Nuclear Medicine Branch, under drip fertigation, as Chharkrt (each with dimensions 10 × 3 mm) were performed and Drchhartkrar. The irrigation system was designed in such a way that Hrkrt of three irrigation line length of 10 meters and a distance of one meter from each other, and then Hrqtrh emitters spaced 0.5 m were considered. For injection of fertilizer elements in the irrigation system, use a fertilizer injection pump. Frvhmkaran Wilson in 2010 tested the effect of phosphorus on spinach Dadndv results showed that increasing soil P level of performance in all phases of plant P increased but not significant.

MATERIALS AND METHODS

In this study, the effect of phosphorus and potassium in soils with different pH evaluated. For this purpose three soils with a pH of 6, 7 and 8 pick and choose some pots and 5 kg of soil poured Hrgldan The Treatments containing phosphorus levels 0, 40 and 80 mg P kg soil as triple super phosphate and potassium source with three levels of 0, 40 and 80 mg kg soil potassium sulfate, potassium added to the pots. The first two seeds in each pot of tomato cultivated varieties of G. We then seed germination and plant four bushes to form stronger hold another've cut surface. After planting the seed treatments applied during plant growth and soil moisture tried about field capacity is N-plants to provide 200 mg of urea nitrogen per kg of soil from the pots Additional. Retention time of 30 days after the first flowering plants in the soil in the pot. National factors that were measured included the number of days required for flowering in each treatment, the number of flowers and fruits of conversion, the total weight and the average weight of each product expressed during tomato, value of fruit sugar, Introduction the acid in fruit fresh weight plant. As we see the number of treatments and the number of iterations, respectively, in this study a total of 27 treatments and 3 replications were 81 pots.

The attributes measured
The number of days for flowering for each pot.
Total fruit.

The pH: the flooding and smooth tomato juice, the pH was measured using pH meter Hvryba model.

Vitamin C: 10 ml of tomato juice smoothie with 20 ml of distilled water and 2 mL of 1% starch using iodine solution in potassium iodide was titrated to achieve the amount of iodine in iodide of potassium, olive green, the amount numeric 8/8 by multiplying the milligrams of vitamin C per 100 cc of juice obtained.

Plant fresh weight after separating from each other, shoot and root weight of each g sensitivity was measured with a laboratory scale.

Dry weight of the plant: plant samples at temperatures between 60 to 75 degrees in the oven vents are placed to dry. After 48 hours, the dried sample weight were recorded.

Total acid: 5 ml of tomato juice smoothie with 5-3 drops of phenol Ftalyn (acid reagent) using Profit 3/0 red headline normal was achieved. Then use the following formula to calculate the total acid milligrams were:

$$TA = \frac{V \times N \times A}{M \times 1000} \times 100$$

Where TA: MG TA, V: The amount of consumer interest, N: normalized profit (3/0), A: Valence hot acid (64) and M: weight of sample (2/5 g), respectively.

Percent of the total soluble solids :value of this attribute using fruit juice smoothie and Rfrktvmtr was measured manually.

Chlorophyll: content in leaves, flowering time of GREENS GREENS system based on chlorophyll meter Minolta Japan was measured.

Statistical calculations
This research is based on a completely randomized design with 27 treatments and 3 replications. Treatments consisted of three levels, 40 and 80 mg per kg of nitrogen, potassium and phosphorus from the soil. Statistical analysis using software MSTA-TC and mean comparison using Duncan's new multiple range test was performed at 1%.

RESULTS

Namber flowers
As can be seen from Table 1.1 Effect of pH on the number of flowers showed significantly decreased with increasing pH of the goal. So that the greatest number of goals pH 6 (3/7 goals) and lowest at pH 8 (9/2 goals) was observed.

Chlorophyll Index
As can be seen from Table 1.1 Effect of pH on specific SHA chlorophyll, chlorophyll indices showed significantly increased with increasing pH. So that the maximum chlorophyll-specific train at pH 8, which is equal to 8/60 compared to pH 7 and 6 had a significant increase in chlorophyll at pH 6 which specific SHA least equal to 6/45 is a significant decrease than pH 7 and 7 is.

Namber Fruit
As can be seen from Table 1.1, which has the highest number of fruits to pH 8 with 0/2, which is a significant increase compared to pH 7. The least number of fruit at pH 7, which is equal to 6/1, which is significantly lower than pH 8 than pH 6 the difference is not statistically significant.

Vitamin C
As can be seen from Table 1.1 the effect of pH has a significant effect on the maximum amount of Vitamin C Vitamin C in pH 7 which equals 51/46 ratio pH 8, and 6 increased has a significant the least amount of vitamin C, which corresponds to pH 8 with 68/38 which is significantly lower than pH 7.

pH
As can be seen from Table 1-1, the maximum amount of fruit PH was related to pH 7 with 42/5 compared to pH 6 increased significantly, but there was no significant difference with respect to pH 8. The least amount of fruit PH pH 6 which equals 97/4, which is significantly lower than pH 7 and 8.

TSS
As can be seen from Table 1-1, the maximum amount of TSS, pH 8, which is equal to 71/5 ratio increased to pH 6 and 7, but this increase was not significant. The lowest rate of TSS at pH 7 is equal to 14/5 is reduced, but this reduction was not significant compared to pH 6 and 8.

The total acid
As can be seen from Table 1-1, the maximum amount of fruit acid to pH 6, which is equal to 716/0, which is a significant increase compared to pH 7 and 8. The least amount of fruit acid to pH 8, which is equal to 572/0, which is significantly lower than pH 7.

Plant fresh weight
As can be seen from Table 1-1 Maximum weight per plant was related to pH 8 with 065/28 had significantly increased compared to pH 7 But there is no significant difference with respect to pH 6. The lowest fresh weight per plant was related to pH 7 with 326/19 which is significantly lower than pH 8.

Plant dry weight
As can be seen from Table 1.1, the highest plant dry weight, pH 8, which is equal to 499/10 which is a significant increase compared to pH 7. The lowest plant dry weight, pH 7, which is equal to 675/7, which is significantly lower than pH 8 than pH 6, but the difference was not statistically significant.

Days to flowering
As can be seen from Table 1.1 the effect of pH has a significant effect on the maximum number of days to flowering, days to flowering was pH 8 with 5/46 compared to pH 7 and 6 increased significantly there was also a minimum number of days to flowering was related to pH 7 with 5/27, which is significantly lower than pH 6 and 8.

Table 1.1 - Comparison of the effect of pH on the traits

PH **Traits**	**6**	**7**	**8**
Number follower	7/3a	4/0b	2/9c
Chlorophyll Index	45/6c	51/6b	60/8a
Number fruit	1/8ab	1/6b	2/0 a
Vitamin **C**(mg)	44/29b	46/51a	38/68c
pH	4/97b	5/42a	5/28a
TSS(%)	5/26b	5/14b	5/71a
total acid(mg)	0/716a	0/567b	0/572b
Wet weight(g)	25/403a	19/326b	28/065a
Dry weight(g)	9/336ab	7/675b	10/499a
Days to flowering	33/0b	27/5c	46/5a

†Means in each column having the same letter, have not significant difference ($P \leq 0.01$) according to DMRT

DISCUSSION

Comparison of treatment effects from the interaction of potassium and phosphorus on the traits
Number of folawer
As is noticeable in Table 2.2 review potassium and phosphorus interaction showed that the highest number of goals in the control treatment (no use of potassium and phosphorus) (0/10 goals) and lowest in the 80 mg per kg of potassium No phosphorus (4/2 goals) was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increasing P concentration, decreased the number of flowers. Medium containing 40 mg l potassium, potassium increases from zero to 40 and 40 to 80 increased the number of flowers decreased significantly.

Chlorophyll Index
As is noticeable in Table 2.2 review potassium and phosphorus interaction showed that maximum chlorophyll index in the treatment of 40 mg of potassium and 80 mg Fsfrbrabrba 9/54 and the least used without phosphorus, potassium, 80 mg kg 5 / 34 was observed. K-free environment, with increased levels of phosphorus, chlorophyll index increase was non-significant. Medium containing 40 mg l Potassium, Potassium increases chlorophyll index increased from zero to 40 and 40 to 80 decreased significantly.
Numbern of Fruit

As is noticeable in Table 2.2 review potassium and phosphorus interaction showed that the highest number of fruits per treatment, 40 mg of potassium and 80 mg of phosphorus equal to 5/2 and the lowest 40 mg kilograms of potassium, without P-1/1 was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increased levels of phosphorus, non-significant increase in the number of fruits. Medium containing 40 mg l potassium, potassium-increasing number of fruits increased from zero to 40 and 40 to 80 decreased significantly.

VitaminC
As is noticeable in Table 2.2 review potassium and phosphorus interaction showed that the highest levels of vitamin C, potassium, and 40 mg Fsfrbrabr with 91/47 and the lowest of 40 mg per kg of potassium and 40 mg kg phosphate

equivalent to 07/41 was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increased levels of phosphorus, vitamin C was significantly reduced. In environments with 40 milligrams per liter of potassium, vitamin C decreased with increasing potassium from zero to 40 and 40 to 80, the difference was not significant.

PH

As is noticeable in Table 2.2 review potassium and phosphorus interaction showed the highest pH in the control treatment (no use of potassium and phosphorus) is equal to 32/5 and the lowest levels of potassium and 80 mg warm up with a 04/5 was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increasing levels of P, the rate of pH decrease was non-significant. Medium containing 40 mg l potassium, pH decreased with increasing the amount of potassium from zero to 40 and 40 to 80, no significant differences were observed.

TSS

As is noticeable in Table 2.2 review showed the greatest amount of interaction with potassium and phosphorus at levels of potassium and 80 mg TSS Fsfrbrabr with 89/5 and the lowest of 40 mg per kg of phosphorus and potassium without control treatment (no use of potassium and phosphorus) which is equal to 00 / 5 was observed . Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus , potassium, and 40 were all destroyed. K-free environment , with increased levels of phosphorus , TSS levels increased significantly . Medium containing 40 mg l potassium, potassium increases from zero to 40 and 40 to 80 increased levels of TSS decreased significantly .

The total acid

As is noticeable in Table 2.2 review potassium and phosphorus interaction revealed that most of the acid in the levels of potassium and 80 mg Fsfrbrabr with 831/0 and lowest in the control treatment (no use of potassium and phosphorus) which equals with 462/0, respectively. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increased levels of phosphorus, total acid increased significantly. Medium containing 40 mg l potassium, total acid decreased with increasing potassium from zero to 40 and 40 to 80 showed a significant increase.

Plant fresh weight

As is noticeable in Table 2.2 review potassium and phosphorus interaction showed the highest plant fresh weight at 40 mg Potassium 80 mg Fsfrbrabr with 564/27 and lowest in the control treatment (no use of potassium and phosphorus) which is equal to 780/19 was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increased levels of phosphorus, plant fresh weight increase was non-significant. Medium containing 40 mg l potassium, plant fresh weight increased with increasing potassium from zero to 40 and 40 to 80 decreased significantly.

Plant dry weight

As is noticeable in Table 2.2 review potassium and phosphorus interaction showed the highest dry weight at 40 mg Potassium and phosphorus levels equal to 769/9 and use the lowest level zero phosphorus, potassium, and 80 mg versus with 742/7 was observed. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus, potassium, and 40 were all destroyed. K-free environment, with increased levels of phosphorus, dry weight was significantly reduced. Medium containing 40 mg l potassium, potassium increases from zero to 40 dry weight increase was significantly reduced from 40 to 80.

Days to flowering

As is noticeable in Table 2.2 review potassium and phosphorus interaction showed the greatest number of days to flowering in the control treatment (no use of potassium and phosphorus) equal to 6/44 and the lowest of 40 mg per kg phosphorus , potassium, and 80 milligrams per kilogram is equal to 1/24 , respectively. Plants grown under the influence of 80 milligrams per liter and 80 mg of phosphorus , potassium, and 40 were all destroyed. K-free environment , with increasing levels of P , the number of days to flowering was significantly decreased . Medium containing 40 mg l potassium, potassium increases from zero to 40 days to flowering decreased from 40 to 80 showed a significant increase .

Table 2.2 - Comparison of treatment effects on the characteristics of the interaction of potassium and phosphorus

Traits TSS(%) **K × P**		Number folower	Chlorophyll Index	Number fruit	Vitamin **C**(mg)	pH
	0	10/0a	49/8a	1/6bcd	39/60b	5/32a	5/00c
Zero	40	7/0b	54/2a	2/0bc	47/91a	5/28a	5/25bc
	80	5/3c	54/7a	2/2ab	47/21a	5/04a	5/89a
	0	5/0c	50/4a	1/1d	41/80b	5/11a	5/00c
40	40	4/5c	50/6a	1/5cd	41/07b	5/29a	5/25bc
	80	2/7d	54/9 a	2/5a	46/20a	5/25a	5/50ab
	0	2/4d	34/5b	1/2d	46/20a	5/25a	5/25bc
80	40	0/0e	49/6a	0/0e	0/00c	0/00b	0/00d
	80	0/0e	51/6a	0/0e	0/00c	0/00b	0/00d

†Means in each column having the same letter, have not significant difference (P ≤ 0.01) according to DMRT

Table 2.2 - Comparison of treatment effects on the characteristics of the interaction of potassium and phosphorus

Traits **K × P**		total acid(mg)	Wet weight(g)	Dry weight(g)	Days to flowering
	0	0/462c	19/780a	7/926a	44/6a
Zero	40	0/595bc	20/424a	9/583a	38/8ab
	80	0/831a	25/990a	7/742a	32/6bc
	0	0/554c	23/940a	9/749a	39/8ab
40	40	0/492 c	26/273a	9/678a	26/8c
	80	0/554c	27/564a	9/513a	24/1c
	0	0/692b	22/728a	9/230a	30/6bc
80	40	0/000d	0/000b	0/000b	0/0d
	80	0/000d	0/000b	0/000b	0/0d

†Means in each column having the same letter, have not significant difference (P ≤ 0.01) according to DMRT

The general conclusions

According to the results of these tests can be expressed using phosphorus and potassium fertilizers to enhance vegetative and reproductive factors in tomato plants to be effective and the positive effect will. The combined use of these two significant interaction effect on vegetative and reproductive tomato plant will separate the use of phosphorus 80 mg, with pH 7 is the best treatment.

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