5. SUMMARY AND CONCLUSION

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Experiments were carried out on a clay loam soil with pH 8.15 at the Experimental Farm Station of the Faculty of Agriculture, Moshtohor-Kalubia during the early summer seasons of 1993 and 1994. Field trails on tomato cv. UC 97-3 aimed to study the effect of N, P and S fertilization levels on plant growth, chemical constituents, fruit yield and quality of tomato. Therefore, three separate experiments were carried out as follows :

First Experiment: Effect of source and level of N-fertilizer on tomato.

This experiment included 12 treatments aimed to study the effect of increasing N-levels (0, 60, 120, 180, 240 and 300 Kg N/fed.) within two sources ; ammonium nitrate or urea on plant growth, chemical constituents, fruit yield and fruit quality of tomato. Results showed that :

1- Vegetative growth :

Tomato plant growth especially fresh and dry weight were increased with increasing N-level up to 120 Kg N/fed. within urea or ammonium nitrate. However, higher levels of N-application (240 or 300 Kg N/fed.) decreased plant growth, as shown in both seasons. Late evaluation of plant growth at fruit setting stage, also showed that adding 120 or 180 Kg N/fed. as ammonium nitrate significantly increased tomato growth compared with other treatments.

2- Mineral content of tomato plant foliage :

Results showed that NO_3-N, total -N and K-content in leaves and/or branches were increased with adding ammonium nitrate as compared with urea, when plants evaluated at flowering stage or at fruit setting stage of both seasons. Regardless to N-form, N and K uptake were increased significantly by increasing level of N-application up to 120 Kg N/fed., but NO_3-N content was gradually and significantly increased by increasing level of N-application up to 300 Kg N/fed. Although P-uptake showed the same response at flowering stage but it was not significantly affected by levels of N-application, at fruit setting stage.

With respect to the interaction effect, data showed that N, P and K uptake were not significantly affected by any treatment of N-level x N-form, at flowering stage, in both seasons. However, evaluation of N and K uptake of foliage, at fruit setting stage showed that they were increased by increasing level of N-application from 0 to 120-180 Kg N/fed. as urea or ammonium nitrate as a general trend in both seasons. However, P-uptake of leaves and/or branches was not significantly affected by any of the interactinal treatments of N-levels within N-forms.

3- Tomato fruit yield :

Ammonium nitrate application gave the highest early, marketable and total yield of tomato fruit as compared with urea. Increasing N-level up to 60 Kg N/fed. gave the highest early yield. however, increasing N-level up to 120 Kg N/fed gave the highest marketable and total yield of tomato fruit. Higher levels of N-application, 240 or 300 Kg N/Fed. decreased early, marketable and total yield production.

With respect to the interactional treatments, data showed that early, marketable and total yield were not significantly affected by N-source within N-level under such conditions of clay loam soil with pH 8.15.

4- Tomato fruit quality :

Ammonium nitrate application increased TSS % and NO_3-N content of tomato fruit . Whereas, urea application significantly increased Vitamin-C content and total acidity only in one season. as compared with ammonium nitrate. Fruit dimensions were not significantly affected by N-source.

Concerning with the effect of N-levels; increasing level of N-application from 0 up to 120 Kg N/Fed. increased average fruit weight but fruit shape was not significantly affected. Total acidity, TSS% and Vitamin-C content were also increased by increasing N-level up to 120 or 180 Kg N/Fed. Heavy N-application (240 and 300 Kg N/fed.) decreased average fruit weight and dry matter % of fruit. Whereas, NO_3-N content of tomato fruit was gradually and significantly increased with increasing N-level from 0 up to 300 Kg N/fed. This increase in NO_3-N content was higher in fruits of plants supplied with ammonium nitrate than with urea.

Conclusion

N-application at 120 Kg N/Fed. as ammonium nitrate is recommended to get the best vegetative growth, mineral uptake, early, marketable and total yield with the best tomato fruit quality. Heavy N-application at 240 or 300 Kg N/Fed. as urea or ammonium nitrate is not recommended to avoid the decrease in plant growth, yield and fruit quality.

Second Experiment: Effect of S within P nutrition on tomato.

This experiment included 12 treatments, aimed to study the effect of fertilization with three sulphur levels within four phosphorus levels on growth, chemical constituents, yield and fruit quality of tomato. Elemental S- levels were 0, 150 and 300 Kg S/fed. and superphosphate levels were 0, 32, 64 and 96 Kg P_2O_5/fed. sulphur was added during soil preparation before transplanting. Treatments were arranged in the field using split plot design; S-levels surved as main plots and P- levels were randomly distributed as sub-plots. The obtained results were as follows:

1- Vegetative growth:

Data of plant growth at flowering or fruit setting stage showed that fresh and dry weight of leaves or branches were significantly increased with increasing level of S-application up to 150 or 300 Kg S/fed. With respect to P-fertilizer levels, 32 or 64 Kg P_2O_5/fed. gave the best plant growth, especially for fresh and dry weight as compared with the higher or lower used P-levels. Therefore the highest value of fresh and dry weight were recorded with application of 32 or 64 Kg P_2O_5/fed within 300 Kg S/fed. followed by the application of 150 Kg S/fed + 64 Kg P_2O_5/fed. but the lowest value were recorded with the control.

It was clear that S-application at high or moderate levels; 300 or 150 Kg S/fed. could save P-fertilizer and reduce the applied level of P-required to get the same effect on plant growth. ***Generally, 150 Kg S equal to save 200 Kg of superphosphate (32 Kg P2O5/fed.).***

2- Mineral content:

Obtained results showed that N, P, K and S content of tomato plant foliage were increased by increasing level of S-application up to 150 Kg S/fed. The highest level of S-application (300 Kg S/fed) did not increase mineral content of tomato plant foliage. With respect to the effect of P-application; N, P, K, and S uptake of plant foliage were significantly increased with increasing levels of P-application up to 32 Kg P_2O_5/fed. in the second season or 64 Kg P_2O_5/fed. in the first season and then decreased by increasing P-level up to 96 Kg P_2O_5/fed.

Concerning the effect of S within P application, data showed that the mineral content of tomato plant foliage was not significantly differed among the interactional used treatments, in the first season. However, in the second season data showed that N, P, K, and S were significantly increased with application of 32 Kg P_2O_5 within 300 Kg S/fed. as compared with other treatments. This trend was true at flowering and fruit setting stages.

3- Tomato fruit yield and its components :

Data showed that early, marketable and total yield were not significantly affected by increasing S-application levels in both seasons. As for P-fertilizer, data showed that early, marketable and total yield were increased with increasing P-application level up to 64 Kg P_2O_5/fed. in both seasons, however, heavy P-application at 96 Kg P_2O_5/fed. decreased early, marketable and total yield.

With respect to the effect of sulphur within phosphorus, data showed that the moderate level of P-application (64 Kg P_2O_5/fed.) within all S-levels gave the highest early, marketable and total yield as compared with the other treatments.

4- Tomato fruit quality:

Results showed that fruit dimensions, average fruit weight, TSS % and Vitamin-C content were not significantly affected by S-application. Fruit dry matter % and total acidity were gradually increased with increasing S-application only in one season.

As for the effect of P-application, data showed that fruit dimensions and TSS % were not significantly affected by increasing P-application levels in both seasons. However, fruit dry matter % and average fruit weight were significantly increased by increasing level of P-fertilizer up to 96 Kg P_2O_5/fed. On the other hand, fruit acidity and Vitamin-C content were decreased by increasing level of P-application only in one season .

With respect to the effect of sulphur within phosphorus, data showed that fruit dimensions, TSS % and average fruit weight were not significantly affected by these interactional treatments in both seasons, but fruit dry matter % was increased by increasing P-application up to 96 Kg P_2O_5/fed within all level of S-application up to 150 or 300 Kg S/fed. within all level of P-application .

Conclusion

64 Kg P2O5 within 150 Kgof elemental S/fed. is recommended to get the best growth, mineral content and the highest early, marketable and total yield with good fruit quality.

Third Experiment: Effect of P within N application on tomato.

This experiment included 20 treatments, aimed to study the effect of increasing N-levels (0, 120, 180, 240 and 300 Kg N/fed.) within P-levels (0, 64, 80 and 96 Kg P_2O_5/fed.) on plant growth, fruit yield and fruit quality of tomato. Experimental design was randomized block design. Results were as follows:

1- Vegetative growth:

Tomato plant growth, fresh and dry weight were increased by increasing levels of N-application up to 120 or 180 Kg N/fed. Moreover, tomato plant growth was increased by increasing level of P-application up to 64 Kg P_2O_5/fed. Whereas, heavy application of nitrogen at 240 or 300 Kg N/fed. or phosphorus at 96 Kg P_2O_5/fed. decreased plant growth.

With respect to interactional treatments, data showed that increasing N-levels within P-levels had no significant effect on tomato plant growth evaluated at flowering or fruit setting stage.

2-Tomato fruit yield and its components :

With respect to N-fertilizer, data showed that 120 Kg N/fed was the best level to get the highest early, marketable and total yield. However, heavy N-application up to 240 or 300 Kg N/fed. decreased early, marketable and total yield of tomato. As for P-fertilizer, data showed that 64 Kg P_2O_5/fed. gave the highest early, marketable and total yield. Moreover, heavy P-application at 80 or 96 Kg P_2O_5/fed. did not increase either early, marketable or total yield. Concerning the interactional treatments, data showed that 120 Kg N + 64 Kg P_2O_5/fed. was the best level of nitrogen within phosphorus to get the highest early, marketable and total yield of tomato fruit.

3- Tomato fruit quality:

With respect to N-fertilizer, data showed that fruit dimension, fruit dry matter % and TSS % were not significantly affected by increasing level of N-application. However, average fruit weight, Vitamin-C and total acidity were increased by increasing level of N-application up to 180 Kg N/fed. NO_3-N accumulation was gradually and significantly increased by increasing level of N-application from 0 up to 300 Kg N/fed. With respect to P-fertilizer, data showed that fruit dimension, average fruit weight, fruit dry matter % , TSS % and Vitamin-C content were not significantly affected by increasing level of P-application .However, total acidity was significantly increased by increasing level of P-application up to 64 Kg P_2O_5/fed. NO_3-N accumulation decreased gradually and significantly by increasing level of P-application.

With respect to nitrogen within phosphorus fertilization, data showed that fruit dimension, average fruit weight and fruit dry matter % were not significantly affected by any of the used interactional treatments of N within P. However, all treatments of N x P improved Vitamin-C content and TSS % of tomato juice as compared with the control. Total acidity were increased by adding 180 Kg N + 64 Kg P_2O_5/fed. Nitrate accumulation in fruits was gradually increased with increasing level of N-application within all levels of P-application.

General conclusion for all trials

As for tomato cv. UC-97-3 grown in the early summer season under open field conditions of clay loam soil with pH 8.15, adding 120 Kg N/fed. as ammonium nitrate + 64 Kg P2O5/fed. +150 Kg S/fed.is recommended to get the best growth, mineral uptake associated with the highest early, marketable and total fruit yield with high fruit quality with a lowering nitrate accumulation in tomato fruits.