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STUDIES ON THE GROWTH AND YIELD OF TOMATO (*SOLANUM LYCOPERSICUM* L.) BASED ON BIOINOCULANTS AND INORGANIC FERTILIZERS

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Abstract

To studies on the growth and yield of Tomato (*Solanum lycopersicum L.*) based on Bioinoculants and inorganic fertilizers. Bioinoculants and inorganic fertilizers to boost the productivity potential of yield of Tomato. Significant difference in all parameter like plant height, number of leaves, leaf area and number of branches due to combined application of Bioinoculants and inorganic fertilizers. Maximum plant height 96.45 cm were observed in treatment 8 containing urea, super phosphate, Muriate of potash, AM Fungi, Phosphobacteria (*Bacillus megaterium)* (each 5g/pot). The maximum number of flowers 37 per plant was produced in T8 treatment and the maximum number of fruits 29 per plant. The highest fruit weight was 90 g observed in T8 and leaf area fairly gives a good idea of photosynthetic capacity of plant. Significant differences were noticed with regards to leaf area index among the treatments at all growth stages.

Keywords: AM Fungi, Phosphobacteria and chemical fertilizers.

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most popular and widely consumed vegetable crops all over the world, and high-quality yield is an essential prerequisite for its economic success in the Saudi Arabia. Tomato has been recently obtaining in relation to the anticipation of some human diseases. This interest is due to the presence of carotenoids and particularly lycopene, which is an unsaturated alkylic compound that appears to be an active compound in the prevention of cancer, cardiovascular risk and in slowing down cellular aging (Di Cesare *et al.,* 2012; Abdel-Monaim, 2012). Lycopene is found in fresh, red-ripe tomatoes as all-trans (79–91%) and cis- (9–21%) isomers (Abdel-Fattah and Al-Amri, 2012). Tomato (*Lycopersicon esculentum Mill.)* is a major horticultural crop with an estimated global production of over 120 million metric tons (F.A.O., 2007).

Present-day agriculture involves usage of pesticides and chemical fertilizers with sprits of increasing the world's food production, this serves as a fast food for plants causing them to grow more promptly and efficiently. Continuous application of chemical fertilizers leads to the reduce decay of soil quality and fertility and might lead to the collection of heavy metals in plant tissues and affecting the fruit nutritional value and edibility (Farnia and Hasanpoor, 2015). Hence, in the recent years, many organic fertilizers have been introduced that act as natural boosters for plant growth. A particular group of organic manures includes outcomes based on plant growth-promoting microorganisms identified as 'Biofertilizers'. These biofertilizers comprised efficient strains of nitrogen fixing or phosphate solubilizing microorganism. Organic farming has appeared as a prime concern area globally in aspect of the growing demand for safe and healthy food, durable sustainability and issue on environmental pollution associated with random use of agrochemicals (Ghany *et al.,* 2013).

Dwivedi, 2015 explained that the AM fungi varies with host ranges. Though they are ubiquitous, they showed that the every taxonomic group of plants and the list of species not infected is probably far of microorganisms like bacteria, fungi and actinomycetes which may help in increasing crop productivity by way of helping in solubilization of insoluble phosphorus, stimulating plant growth by providing hormones, vitamins and other growth promoting substances. Phosphate Solubilizing Bacteria (PSB) are capable of hydrolyzing organic and inorganic phosphorus from insoluble compounds and PSB produce phosphatase like phytase that hydrolyse organic forms of phosphate compounds efficiently (Zehra, 2010). P fertilization in spite of reducing root colonization and community structure of AM fungi can still contribute substantially to P nutrition of plants (Sivakumar and Divakaran, 2019).

Materials and Methods

Present works was carried out in a Randomized complete block design (RCBD) at department of microbiology, Faculty of Agriculture, Annamalai university, Annamalai Nagar. The physical and chemical properties of experimental soil, which was used for pot culture study. The soil physical and chemical properties such p^H, Nitrogen (Jackson, 1958), Phosphorus (Jackson, 1958), Potassium (Peach and Tracey, 1956) content were analyzed. Micronutrient such as Zn, Fe, Cu and Mn were analyzed. Seed material of tomato variety – PKM 1 was obtained from Horticultural College and Research Institute, Periyakulam. The raised seed bed of 2×2m size was prepared and tomato seeds were soaked in one cm depth in the rows spaced at 5 to 6 cm and covered with thin layer of soil. 30 days seedlings were transplanted to the trial pot.

The AM Fungi *Glomus fasciculatum* and PSB *Bacillus megaterium* were obtained from Department of Microbiology, Faculty of Agriculture, Annamalai university

(Fig 1). The treatments were T-1 urea (5g/pot),T-2 super phosphate (5g/pot), T-3 Muriate of potash (5g/pot), AM Fungi (5g/pot), T-5 Phosphobacteria (*Bacillus megaterium*) (5g/pot),T-6 urea, super phosphate, Muriate of potash (each 5g/pot), T-7 AM Fungi, Phosphobacteria (*Bacillus megaterium*) (each 5g/pot), T-8 urea, super phosphate, Muriate of potash, AM Fungi, Phosphobacteria (*Bacillus megaterium*)(each 5g/pot) and T-9 control. The N, P and K Contents of the manures were tested in the laboratory and according to the results, the doses of manures were set in such in way that all the treatments contain same amount of N, P and K. Five plants were selected randomly from each unit pot to record yield contributing characters (Fig. 2). All the practical management included mulching, weeding, and other agronomic treatments were done by manually. Irrigation was were done based on plant requirement. In maturity time, fruit yield, number of fruits per plant, total plant height, shoot length, root length, number of branches per plant, number of leaves, fruit length and fruit width were measured. The collected data were analyzed statistically by F-test to examine the treatment effects and the mean differences were adjusted by Duncan's Multiple Range test (DMRT) (Gomez and Gomez, 1984).

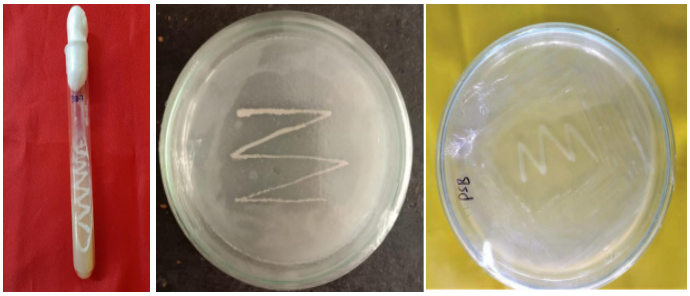

Fig. 1 : Pure culture of Phosphobacterial Isolates

Fig. 2 : Over all view of Pot culture Experiment

Results and Discussion

The present study was observed that the application of Bio inoculants and inorganic fertilizers only or combined application had a great impact at all the stages of the crop. Significant differences in all parameters like plant height, number of fruit, plant height, number of leaves, leaf area and number of branches due to the combined application of bio inoculant and inorganic fertilizers. Maximum plant height (96.45cm) was observed in T8 (Fig 3). The data on shoot length (72.45 cm), and the root length (22.00 cm) as influenced by the combination of bio inoculant and inorganic fertilizers showed significant differences among the treatment at the all the stages. The highest number of branches per plant (13.00 nos) was recorded in treatment T8.Highest fruit weight in T8 was (90.00 g). Total number of leaf observed 34.00 per plant was observed in T8 and leaf area fairly gives a good idea of photosynthetic capacity of the plant.

Similar results were reported by Naidu *et al.*,(1999) revealed that the morphological parameters were affected significantly due to the application of different combination of organics, chemicals, biofertilizers. Satya Vani (2014) described that mycorrhizal spore population in rhizosphere soil as well as the percentage of mycorrhizal infection in plant roots fluctuated with the changes in physico-chemical factors of the soils of tomato. So that the enlargement in cell size and cell division which might have helped in plant height, number of leaves,branches and fruits per plant. These results are in agreement with those reports of Nanthakumar and Veeraraghavathatham (2009), Anburani and Manivannan (2002), and in tomato.

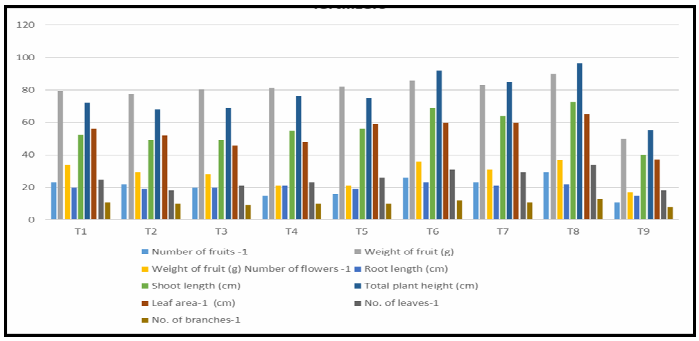

Fig. 3 : Comparative studies on the growth and yield of Tomato (*Solanum melongena L.*) var PKM 1 based on Bio inoculants and inorganic fertilizers

A notable differences were noticed with regard to leaf area index among the treatments at all growth stages. The treatments 8 showed significantly higher leaf area index (65.00 cm). The increase in leaf area index could be attributed to increased cell division and elongation resulting in increased leaf expansion, more numbers of leaves due to beneficial influence of bio inoculants which release growth promoting substances and enhances the availability of phosphorus. From the data it appeared that flowering and fruiting of tomato were positively influenced by sources of nutrients applied. The maximum numbers of flowers (37.00/plant) per plant was produced T8 treatment and the maximum number of fruits (29.00/plants). Phosphate solubilizing Bacteria (PSB) are groups of beneficial bacteria capable of hydrolyzing organic and inorganic phosphorous from insoluble compounds. Chen *et al.* (2006) P-solubilization ability of the microorganisms is considered to be one of the important traits associated with the plants phosphate nutrition. The cost of inorganic fertilizers has been enormously increasing to an extent that they are out of reach of the poor, small and marginal farmers. It has become impractical to apply such costly inputs for crops of marginal returns. The use of bio inoculants in such situation is therefore a practically paying proposal. Based the results it was concluded that the application of bio inoculants and inorganic fertilizers was found more beneficial and significantly improved growth parameters and yield components in tomato. The benefits cost ratio was found lesser in using both bio inoculants and inorganic fertilizers compared to using chemical fertilizers alone in tomato crop cultivation.

Conclusion

It is inferred from the present study that majority of growth and yield parameters displayed good amount of variability upon the growth and yield of Tomato (*Solanum lycopersicum* L.) based on Bioinoculants and inorganic fertilizers. Thus, Bioinoculants and inorganic fertilizers exerted a profound influence on various horticultural traits and significant differences in all parameters like plant height, number of fruit, plant height, number of leaves, leaf area and number of branches due to the combined application of bio inoculant and inorganic fertilizers. On the basis of present finding, it can be concluded that combined application of Bio inoculants and inorganic fertilizers had a great impact and significantly increased growth as well as yield attributes in tomato crop.

References

Abdel-Fattah, G.M. and Al-Amri, S.M. (2012). Induced systemic resistance in tomato plants against *Fusarium oxysporium* F. sp. *lycopersici* by different kinds of compost. Afr. J. Biotechnol. 11: 12454–12463.

Abdel-Monaim, M.F. (2012). Induced systemic resistance in tomato plants against Fusarium wilts diseases. Inter. Res. J. Microbiol. 3: 14–23.

Aminifard, M.H.; Aroiee, H.; Fatemi, H.; Ameri, A. and Karimpour, S. (2010). Responses of eggplant (*Solanum melongena* L.) to different rates of nitrogen under field conditions. JCEA, 11(4): 453-458.

Anburani, A. and Manivannan, K. (2002). Effect of integrated nutrient management on growth in tomato (*Solanum melongena* L.) CV. Annamalai. South Indian Horticulture, 50(4-6):377-386.

Chen, G.C.; He, Z.L.; Stoffella, P.J.; Yang, X.E. and Yu, S. (2006). Calvert D use of dolomite phosphate rock (DPR) fertilizers to reduce phosphorous leaching from sandy soil. Environmental pollution, 139: 176-182.

Di-Cesare, L.F.; Migliori, C.; Ferrari, V.; Parisi, M.; Campanelli, G.; Candido, V.; Perrone D. (2012). Effects of irrigation-fertilization and irrigation-mycorrhization on the alimentary and nutraceutical properties of tomatoes. In: Lee T.S., editor. Irrigation Systems and Practices in Challenging Environments. In TECH Press; Rijeka, China, 207–332.

Dwivedi, O.P. (2015). Distribution and Association of ArbuscularMycorrhizal Fungi in Different Cultivars of Wheat from Lalganj Pratapgarh District of Utter Pradesh. India Advances in Bio Sci. and Bio Tech., 353-357.

FAO (Food and Agricultural Organization) (2007) FAOStat, core production 2005. Available online: http://faostat. fao. org/ site/340/default.aspx

Ghany, T.M.A. *et al* (2013). Role of biofertilizers in agriculture: a brief review. Mycopath. 11(2): 95-101

Gomez, K.A. and Gomez, A.K. (1958). Statistical procedures for agricultural research. 2nd edn. John Wiley and Sons. New York. 207-215.

Jackson, M.L. (1973). Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi.

Jose, D. and Shanmugavelu, T. (1988). Studies on the efficiency of organic and inorganic form of nitrogen in tomato. Indian journal of Horticulture, 45:100-103.

Naidu, A.K.; Kushwah, S.S. and Diwivedi, Y.C. (1999). Performance of organic manures, bio and chemical fertilizers and their combination on microbial population of soil and growth of okra. Jawaharlal Nehru Krishi Vishwa Vidhyalaya Research Journal, 33(1-2): 34-38.

Nanthakumar, S. and Veeraraghavathatham, D. (2000). Effect of integrated nutrient management on growth parameters and yield of tomato (*Solanum melongena* L.) cv PLR 1. South Indian Horticulture, 48(1-6): 31-35.

Pal, S.; Saimbhi, M.S. and Bal, S.S. (2002). Effect of nitrogen and phosphorus level on growth and yield of tomato hybrid (*Solanum melongena* L.). J.Veg. Sci., 29: 90-91.

Rahman, M.H.; Hosain, M.A. and Kawai, K. (1998). Potentially of swamp for fish culture in Bangaladesh. Japan Aquaculture society, svisanzoshku. 46(4): 481-486.

Rathier, T.M. and Frink, C.R. (1989). Nitrate in runoff water from container grown juniper and Alberta spurce under different irrigation and N fertilization regimes. J Environ Horticul. 7(1): 32-35

Satya, V.M.; Hindumathi, A. and Narsimha, R.B. (2014). Arbuscular mycorrhizal fungi associated with rhizo-sphere soils of tomato cultivated in Andhra Pradesh, India. Int. J. Curr. Microbiol. App. Sci., 3(5): 519-529.

Sivakumar, K. and Divakaran, J. (2019). Synergistic effect between Phosphate Solubilising Bacteria and Arbuscular Mycorrhizal Fungi on Growth and P uptake in *Zea mays*. Journal of Pharmacognosy and Phytochemistry. SP2 (2019): 590-59

Tomati, U.; Galli, E.; Grappelli, A. and Dilena, G. (1990). Effect of earthworm casts on protein synthesis in radish (*Raphanus sativum*) and lettuce (*Lactuca sativa*) seedlings. Biology and fertility of soils, 9: 288-289.

Zehra, E. (2010). Performance of phosphate solubilizing bacteria for improving growth and yield of sunflower (*Helianthus annuus* L.) in the presence of phosphorus fertilizer. Af. J. Biotech. 9: 3794-00.