IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EFFECT OF FERTIGATION ON PHOSPHORUS AVAILABILITY IN TOMATO CROP

[1]Prof Kiran Yadav, [2]Prof Vijay Patil, [3]Prof Appasaheb Khot, [4]Prof Sangita Bhoi, [5]Prof Snehal Patil [1]Assistant Professor ,[2]Assistant Professor,[3]Assistant Professor, [4]Assistant Professor, [5]Assistant Professor [1]Department of Agronomy,

[1]College Of Agriculture, Kadegaon-415304, India

Abstract: An experiment was conducted to study the effect of fertigation on nitrogen availability in Tomato crop. The treatments included 100% FII (Fertigation– Irrigation–Irrigation), 100% IFI (Irrigation-Fertigation-Irrigation), 100% IIF (Irrigation-Irrigation-Fertigation), 100% FFF (Fertigation during complete irrigation time), 75% fertigation (as per schedule B) + 25 % soil application, 50% fertigation (as per schedule C) + 50 % soil application, 25% fertigation (as per schedule D) + 75 % soil application, DI with 100% CF (NK-drip and P-soil), SI with 100% CF + 2% foliar spray of 17:44:00 at 30, 45 and 60 DAP, SI with 100% CF, DI with no fertilizer. The application of fertilizers in the second tertile of the irrigation period resulted into significantly maximum availability of phosphorus during both the years and pooled mean. While application of fertilizer in the third tertile of the irrigation period found second in order in respect of availability of phosphorus during both the years and pooled mean. The 75% fertigation + 25% soil application observed significantly maximum uptake of phosphorous during first year, second year and pooled mean. Drip irrigation with no fertilizers resulted minimum uptake and availability of phosphorus during both the years and in pooled mean.

Index Terms: Tomato, Fertigation, Phosphorous availability, Drip irrigation.

I INTRODUCTION

Tomato is known as protective food is being extensively grown all over the world both for fresh market and processing. Tomato has originated in Peru, Latin America (Villareal, 1979). Tomato production has increased in both open field and greenhouse in recent decades and about 14 per cent of the world's vegetable production is accounted for tomato (Henareh, 2015). Tomato is an important cash generating crop for small scale farmers and also provides employment opportunities in production and processing industries (Meena et al., 2015). Lycopene is the principal carotenoid, causing the characteristic red colour of tomatoes used in treating various chronic human diseases like cancer, cardiovascular diseases, osteoporosis and diabetes. The red pigment (lycopene) in tomato is now being considered as the "world's most powerful natural antioxidant". Therefore, tomato is one of the most important "protective foods" because of its special nutritive value (Shankar et al., 2013). The fertilizer application is one of the most important factors for obtaining economical yield of tomato.

Next to nitrogen, phosphorus (P) is the second most important macronutrient as an essential plant nutrient. It is a key nutrient for higher and sustained agricultural productivity and which limits plant growth in many soils. Nitrogen and phosphorus are the two essential macronutrients to crops which improve their growth, yield and product quality (Chen et al., 2008). Phosphorus termed as the "key of life" for plant because of its direct involvement in most life processes (Amapu, 1998). Phosphorus forms an important component of the organic compound adenosine triphosphate (ATP), which is the energy currency that drives all biochemical processes in plants. It is also an intergral component of nucleic acids, coenzymes, nucleotides, phosphoproteins, phospholipids and sugar phosphates as well as intermediates of signal transduction events. It is also involved in an array of processes in plants such as photosynthesis, respiration, nitrogen fixation, flowering, fruiting, and maturation. Plant dry matter may contain up to 0.5% phosphorus.

II MATERIAL AND METHODS

The present investigation was conducted during the *Rabi* season of the year 2018 and 2019 at College farm of the Department of Agronomy, College of Agriculture, Kadegaon, Affiliated to Mahatma Phule Krishi Vidyapeeth, Rahuri. The soil was well drained, silty clay loam in texture pH-7.80 with low in available nitrogen (215.2 kg ha-1), medium in phosphorus (17.5 kg ha-1) and high in potassium (332 kg ha-1). The field capacity, permanent wilting point and bulk density were 35.20 per cent, 17.00 per cent and 1.30 g cm-3, respectively. The experiment was laid out in random block design and replicated thrice with eleven treatment combinations. The treatments included 4 fertigation timing (100% FII (Fertigation–Irrigation–Irrigation) fertigation in first tertile of the irrigation period, 100% IFI (Irrigation-Fertigation-Irrigation) fertigation in second tertile of the irrigation period, 100% IIF (Irrigation- Irrigation-Fertigation) fertigation in third tertile of the irrigation period, 100% FFF (Fertigation during complete irrigation period) and 7 fertigation schedule (75% fertigation (as per schedule B) + 25% soil application, 50% fertigation (as per schedule C) + 50% soil application, 25% fertigation (as per schedule D) + 75 % soil application (Table 1), DI with 100% CF (NK-drip and P-soil), SI with 100% CF + 2% foliar spray of 17:44:00 at 30, 45 and 60 DAP, SI with 100% CF, DI with no fertilizer. The four week old healthy and uniform tomato seedlings were transplanted at the spacing of 1.05 x 0.45 cm on the raised beds. The fertigation was done by using water soluble fertilizer urea (46% N), urea phosphate (17:44:0) and muriate of potash (0:0:60). Straight fertilizer urea, single superphosphate and muriate of potash were used as conventional for surface irrigation. All the agronomic practices and plant protection measures were adopted as per recommendation.

Soil samples was collected before planting and analyzed for available P content. The available Phosphorus analysed by Olsen's method. Olsen's extractant of 40 ml (0.5 M NaHCO3) was used in 2 g of soil sample and shaked for 30 minutes (Olsen et al., 1954). Extrant was filtered and 5 ml extractant with drop of P nitrophenol indicator was acidified with 2.5 N H2SO4. The 4 ml of reagent B was added and the volume of 25 ml with distilled water was made. The contents were shaked and after 10 minutes the intensity of blue colour (absorbance) was measured at 680 nm wave length in a spectrophotometer. The absorbance value was incorporated in the standard graph and the concentration of P in the colored solution was obtained.

III Results and Discussion

The application of fertilizer in the second tertile of the irrigation period exhibited significantly maximum phosphorus availability at all the crop growth stages during first year, second year and pooled mean. It might be due to application of water soluble fertilizer with irrigation water. The increase in fertigation level increases the availability of nutrients as observed by Abdelraouf and Ragab (2018) and Shaymaa *et al.* (2009).

Among the split fertilized treatments, 75% fertigation + 25% soil application registered significantly maximum availability of phosphorus as 35.63, 30.33, 26.87, 21.75, 16.20 and 35.65, 27.59, 24.42, 20.54, 13.71 and 35.64, 28.96, 25.64, 21.14, 14.96 kg ha^{-1} at 60, 90, 120, 150 days after transplanting and at harvest during 2014-15, 2015-16 and pooled mean, respectively as compared to 50% fertigation + 50% soil application, 25% fertigation + 75% soil application and drip irrigation with 100% conventional fertilizer (NK-drip and P-soil). The phosphorus availability was increased with period from sowing up to 60 days after transplanting and afterwards decreased up to harvesting stage. The decreased phosphorus availability in soil after 60 days after transplanting may be due to higher uptake of phosphorus by plants at fruit formation stage. The levels of fertilizer had influenced the phosphorus availability in soil up to some extent. The nutrient availability was increased with increase in fertigation level. These results are in line with the findings of Nalina *et al.* (2009), Pawar *et al.* (2018) and Rimcharoen and Wonprasaoid (2016).

In conventional fertilized treatments, the surface irrigation with 100% conventional fertilizer and foliar spray at 30, 60, 120, 150 days after transplanting registered higher availability of phosphorus as 33.50, 30.50, 24.25, 21.75, 16.75, 14.75 and 32.65, 31.52, 24.51, 21.57, 17.45, 12.70 and 33.07, 31.01, 24.38, 21.66, 17.10, 13.73 kg ha^{-1} at 30, 60, 120, 150 ays after transplanting and at harvest during 2014-15, 2015-16 and pooled mean, respectively. Similar results were noted by Pawar *et al.* (2018) and Rimcharoen and Wonprasaoid (2016).

Minimum availability of phosphorus noticed under drip irrigation with no fertilizer as 16.49, 15.92, 14.43, 14.20, 13.87, 11.13 and 13.63, 11.53, 10.54, 10.00, 9.73, 8.47 and 15.06, 13.73, 12.48, 12.10, 11.80 kg ha^{-1} at 30, 60, 90, 120, 150 days after transplanting and at last harvest during 2014-15, 2015-16 and pooled mean, respectively.

Table 1 Phosphorus availability in soil as influenced by different treatments (2018-2019)

Treatment		Phosphorus availability (kg/ha)					
		2018-2019					
		30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	At harvest
T_1 :	100% FII (Fertigation–Irrigation– Irrigation) fertigation in first tertile of the irrigation period	27.12	37.24	32.12	24.93	19.63	16.90
T_2 :	100% IFI (Irrigation-Fertigation-Irrigation) fertigation in second tertile of the irrigation period	30.25	39.32	38.30	30.55	26.87	17.00
T_3 :	100% IIF (Irrigation- Irrigation-Fertigation) fertigation in third tertile of the irrigation period	29.15	42.21	37.30	27.34	22.72	17.52
T_4 :	100% FFF (Fertigation during complete irrigation period)	28.21	42.96	34.71	26.89	21.74	18.70
T_5 :	75% fertigation (as per schedule B) + 25% soil application	24.64	35.63	30.33	26.87	21.75	16.20
T_6 :	50% fertigation (as per schedule C) + 50% soil application	25.86	33.88	27.54	22.37	17.68	15.74
T_7 :	25% fertigation (as per schedule D) + 75% soil application	27.62	34.13	29.11	24.54	19.23	15.57
T_8 :	DI with 100% CF (NK-drip and P-soil)	35.24	31.87	26.37	21.55	17.48	16.40
T_9 :	SI with 100% CF +2% foliar spray of 17:44:00 at 30, 45 and 60 DAP	33.50	30.50	24.25	21.75	16.75	14.75
T_{10} :	SI with 100% CF	32.52	29.11	23.61	20.11	15.61	14.37
T_{11} :	DI with no fertilizer	16.49	15.92	14.43	14.20	13.87	11.13
	SE±	1.462	0.567	0.422	0.284	0.132	0.739
	C.D. at 5 %	4.314	1.674	1.247	0.839	0.389	2.182
	General mean	28.24	33.89	28.92	23.74	19.39	15.84

Table 2 Nitrogen availability in soil as influenced by different treatments (2019-2020)

Treatment		Phosphorus availability (kg/ha)					
		2019-2020					
		30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	At harvest
T_1 :	100% FII (Fertigation–Irrigation– Irrigation) fertigation in first tertile of the irrigation period	26.49	36.59	32.69	25.32	21.69	13.77
T_2 :	100% IFI (Irrigation-Fertigation-Irrigation) fertigation in second tertile of the irrigation period	29.41	39.52	35.57	28.61	24.33	15.71
T_3 :	100% IIF (Irrigation- Irrigation-Fertigation) fertigation in third tertile of the irrigation period	28.54	38.60	34.36	27.62	23.50	14.77
T_4 :	100% FFF (Fertigation during complete irrigation period)	27.61	37.52	33.58	26.66	22.51	14.48
T_5 :	75% fertigation (as per schedule B) + 25% soil application	23.49	35.65	27.59	24.42	20.54	13.71
T_6 :	50% fertigation (as per schedule C) + 50% soil application	24.55	34.63	26.52	23.41	18.39	13.36
T_7 :	25% fertigation (as per schedule D) + 75% soil application	26.56	32.47	25.49	22.71	17.63	13.28
T_8 :	DI with 100% CF (NK-drip and P-soil)	33.43	35.46	27.49	23.73	19.46	13.60
T_9 :	SI with 100% CF +2% foliar spray of 17:44:00 at 30, 45 and 60 DAP	32.65	31.52	24.51	21.57	17.45	12.70
T_{10} :	SI with 100% CF	31.49	29.49	23.57	20.58	16.57	12.20
T_{11} :	DI with no fertilizer	13.63	11.53	10.54	10.00	9.73	8.47
	SE±	0.236	0.136	0.205	0.129	0.117	0.149
	C.D. at 5 %	0.696	0.403	0.605	0.381	0.346	0.440
	General mean	27.08	33.00	27.45	23.15	19.25	13.28

Table 3 Nitrogen availability in soil as influenced by different treatments (Pooled mean)

Treatment		Phosphorus availability (kg/ha)					
		Pooled mean					
		30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	At harvest
T_1 :	100% FII (Fertigation–Irrigation– Irrigation) fertigation in first tertile of the irrigation period	26.80	36.92	32.41	25.13	20.66	15.33
T_2 :	100% IFI (Irrigation-Fertigation-Irrigation) fertigation in second tertile of the irrigation period	29.83	39.42	35.14	27.75	23.04	17.21
T_3 :	100% IIF (Irrigation- Irrigation-Fertigation) fertigation in third tertile of the irrigation period	28.84	40.41	35.83	27.48	23.11	16.14
T_4 :	100% FFF (Fertigation during complete irrigation period)	27.91	40.24	35.94	28.60	24.69	15.74
T_5 :	75% fertigation (as per schedule B) + 25% soil application	24.07	35.64	28.96	25.64	21.14	14.96
T_6 :	50% fertigation (as per schedule C) + 50% soil application	25.21	34.26	27.03	22.89	18.04	14.55
T_7 :	25% fertigation (as per schedule D) + 75% soil application	27.09	33.30	27.30	23.62	18.43	14.43
T_8 :	DI with 100% CF (NK-drip and P-soil)	34.34	33.66	26.93	22.64	18.47	15.00
T_9 :	SI with 100% CF +2% foliar spray of 17:44:00 at 30, 45 and 60 DAP	33.07	31.01	24.38	21.66	17.10	13.73
T_{10} :	SI with 100% CF	32.00	29.30	23.59	20.35	16.09	13.28
T_{11} :	DI with no fertilizer	15.06	13.73	12.48	12.10	11.80	9.80
	SE±	1.05	0.41	0.33	0.22	0.13	0.53
	C.D. at 5 %	2.99	1.18	0.95	0.63	0.36	1.53
	General mean	27.66	33.44	28.18	23.44	19.32	14.56

IV REFERENCES

[1] Abdelraouf, R.E. and Ragab, R. 2018. Effect of fertigation frequency and duration on yield and water productivity of wheat: field and modelling study using the saltmed model. *Irrigation and Drainage* **67**(3).

[2] Amapu I Y. 1998. Potential of Sokoto phosphate rock as alternative phosphate fertilizer for the sub-humid savanna of Nigeria. Ph. D. Thesis, Ahmadu Bello University, Zaria, Nigeria.

[3] Chen Y F, Wang Y and Wu W H. 2008. Membrane transporters for nitrogen, phosphate and potassium uptake in plants. *Journal of Integrative Plant Biology* **50**: 835-848.

[4] Henareh M. 2015. Genetic variation in superior tomato genotype collected from North West of Iran. International Journal of Scientific Research in Environmental Sciences 3(6): 219-225.

[5] Meena O P, Bahadur V, Jagtap A B, Saini P and Meena Y K. 2015. Genetic variability studies of fruit yield and its traits among indeterminate tomato genotypes under open field condition. African Journal of Agricultural Research 10(32): 3170-3177.

[6] Nalina, L., Kumar, N., Soorianathasundram, K. and Jeyakumar, P. 2009. Effect of different nutrient levels on growth and development of tissue cultured banana cv. Robusta (AAA). *Indian Journal of Horticulture.* **66**(2) : 169-174.

[7] Pawar, D.D., Kale, K.D., Dingre, S.K. and Hasure, R.R. 2018. Yield, Water and Nutrient Use of Wheat as influenced by Water Soluble Fertilizers in Inceptisols. *Journal of Agricultural Research and Technology*. **43**(1) : 115-120.

[8] Rimcharoen, Y. and Wonprasaid, S. 2016. Effects of fertigation on root and plant nutrient distribution of field grown tomato *(Lycopersicon esculentum* Mill.). *International Journal of Research in Chemical, Metallurgical and Civil Engineering*. **3**(2), ISSN 2349-1442 EISSN 2349-1450.

[9] Shankar A, Reddy R V S K, Sujatha M and Pratap M. 2013. Genetic variability studies in F1 generation of tomato (Solanum lycopersicum L.). Journal of Agriculture and Veterinary Science 4(5): 31-34.

[10] Shaymaa, I.S., Sahar, M.Z., and Yassen, A.A. 2009. Effect of method and rate of fertilizer application under drip irrigation on yield and nutrient uptake by tomato. *Ozean Journal of Applied Sciences.* **2**(2): 4-6.

[11] Villareal R L. 1979. Tomato production in the tropics-problem and progress. Proceedings of the international symposium on tropical tomato. October 23-27. 1978, Taiwan, China. 6-12.