International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 7; Issue 10(B); October 2018; Page No.15799-15802
DOI: http://dx.doi.org/10.24327/ijcar.2018.15802.2897

Research Article

ENRICHED VERMICOMPOST WITH MICRONUTRIENTS AND FOLIAR SPRAY ON TOMATO (cv. PKM-1) BOOSTING YIELD AND QUALITY IN SALINE SOIL

Senthilkumar N

Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar-608 002. (TN) India

A R T I C L E I N F O

Article History:

Received 4th July, 2018
Received in revised form 25th August, 2018
Accepted 23rd September, 2018
Published online 28th October, 2018

Key words:

Tomato, growth, yield, enriched vermicompost, micronutrients and saline soil.

A B S T R A C T

A field experiment was conducted during 2014 at Theerthampalayam village, Cuddalore District, Tamil Nadu with tomato cv., PKM-1. The experimental soil was sandy loam with a pH of 8.41, EC of 4.02 dS m^{-1} and CEC of 15.20 cmol (p^{+}) kg^{-1}. The available nitrogen, phosphorus and potassium content were 216, 9 and 150.7 kg ha^{-1} respectively The treatments were T_1- 20 kg of $ZnSO_4$ + 5.0 kg of borax as soil application. T_2-T_1+pressmud @ 12.5 t ha^{-1}. T_3- 10 kg of $ZnSO_4$+ 2.5 kg of borax as soil application+ pressmud @ 12.5 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax of F.S on 45 and 60 DAT. T_4- 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with pressmud @ 12.5 t ha^{-1} + 0.50% $ZnSO_4$+0.40% borax as F.S on 45 and 60 DAT. T_5-T_1+vermicompost @ 4 t ha^{-1}. T_6 - 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application + vermicompost @ 4 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT. T_7- 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT. The experiment was laid out in Randomized Block Design (RBD) and replicated three times. The growth attributes *viz.,* plant height was recorded on 25, 50 and 75 days after transplanting. The results of the experiment clearly revealed that the application of (T_7)10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT significantly influenced the growth, yield (fruit,684.25q $ha^{-1}$and straw,3142.33 kg ha^{-1}) and quality (45.40 mg 100 g^{-1}).

INTRODUCTION

Tomato (*Lycopersicom esculentum* L.) is one of the important crop in the world. It occupies an important place in view of its nutritive value, multivarious use and tops the list of processed vegetables. Tomato is an important mineral, protein and vitamin rich vegetable crop which plays a vital role in Indian economy by virtue of its various modes of consumption in human diet. India is the world second largest producer of vegetables next to china. The present production of vegetable has to be raised to 250 million tonnes by 2025. Although production is almost doubled during the last three decades, the technology used and practices adopted are predominantly traditional. This results in low productivity and poor quality of vegetables are considered as productive supplementary of food as they contain large quantities of minerals, vitamins and essential amino acids, which are required for normal functioning of the human metabolic process.

Corresponding author:* **Senthilkumar N
Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar-608 002. (TN) India

Though we have attained food security through enhancement of cereal production the much needed nutrition security can be achieved only through fruits and vegetables and hence, there is an imperative need to double the production from its present levels so as to meet the per capita supply of 210 g per day.

In India, it is grown in an area of 6.1 lakh hectares with an annual production of about 8.0 million tonnes (FAO, 2013) and in Tamilnadu, it is grown in an area of 0.46 lakh hectare with an annual production of 0.36 million tonnes (Namasivayam, 2014).The average productivity of tomato in India is only 17.5 t ha^{-1} which is very low as compared to the world average production of tomato (25 t ha^{-1}). For increasing the high quality and quantity it needs to apply high amount of fertilizers, it leads to affect the soil parameters and affect the soil health. In recent years, adoption of high yielding varieties and use of high analysis NPK fertilizers led to decline in the micronutrient status in soil to below normal at which productivity of crops cannot be sustained (Kumar and Babel, 2011). Velu *et al*. (2008) reported that 67 per cent of the soils of Cuddalore district were deficient in available Zinc (Zn) which needed attention towards Zn management in crops. Copper (Cu) and Iron (Fe) were deficient to the extent of 4 and 26 per cent respectively. Hence, it is an imperative need to

develop a technology which improves the yield of crop without affecting the quality of produces as well as soil health. In Tamil Nadu about 57 and 44 per cent of total area is deficient in Zn and B respectively. Growing of tomato in such nutrient deficient soil is also one of the reasons for low productivity. Micronutrient management especially the Zn and B assumes greater significance for tomato production by their specific role in growth and metabolic activities.

Soil salinity is considered as one of the major environmental stress which adversely affects plant growth and metabolism resulting in considerable losses in crop productivity. Salinity has affected more than 800 million hectares of land throughout the world which is almost 6% of the world's total land area (Anonymous, 2008). In arid and semiarid regions, use of low quality water for irrigation, limited rainfall, high evapotranspiration, high temperature and faulty soil management have further contributed to the salinity problem. Apart from naturally existing saline lands, a significant proportion of recently cultivated agricultural land has become saline due to secondary salinity as a result of the human activity. Soil salinity affects plants in two ways viz., high concentrations of salts in the soil make it harder for roots to extract water while high concentrations of salts within the plant become toxic for growth (Munns & Tester, 2008).

To cope with toxic effect of salts, plants develop biochemical and molecular mechanisms which include compartmentalization of ions at cellular and whole-plant level, synthesis of compatible solutes, change in photosynthetic pathway, alteration in membrane structure, induction of antioxidative enzymes and plant hormones (Flowers *et al*., 2010).

In India Salt affected soils are found in 2.95 million hectare. In Tamil Nadu it is 13,231 ha. Saline soil defined as soil having a conductivity of the saturation extract greater than 4 dS m^{-1} and exchangeable sodium percentage less than 15. pH is usually less than 8.5, Formerly these soils were called white alkali soil because of surface crust of white salts. Osmotic pressure is high enough to prevent absorption of moisture and plant nutrients from such soils. (Mioli Mandal *et al.,* 2009).The results are quite encouraging, present investigation was carried out to achieve the yield and quality of tomato in saline soil.

MATERIALS AND METHODS

A field experiment was conducted during 2014 at Theerthampalayam village, Cuddalore District, Tamil Nadu with tomato cv., PKM-1. The experimental soil was sandy loam with a pH of 8.41, EC of 4.02 dS m^{-1} and CEC of 15.20 cmol (p^+) kg^{-1}. The available nitrogen, phosphorus and potassium content were 216, 9 and 150.7 kg ha^{-1} respectively. The available zinc and boron contents were 0.67 and 0.29 mg kg^{-1}. The exchangeable calcium, magnesium, potassium and sodium contents were 5.3, 2.9, 3.2 and 3.8 cmol (p^+) kg^{-1} respectively. The treatments consisted of application of bio fortification technic with micronutrients. The treatments were T_1- 20 kg of $ZnSO_4$ + 5.0 kg of borax as soil application. T_2- T_1+pressmud @ 12.5 t ha^{-1}. T_3- 10 kg of $ZnSO_4$+ 2.5 kg of borax as soil application+ pressmud @ 12.5 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax of F.S on 45 and 60 DAT. T_4- 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with pressmud @ 12.5 t ha^{-1} + 0.50% $ZnSO_4$+0.40% borax as F.S on 45 and 60 DAT. T_5-T_1+vermicompost @ 4 t ha^{-1}. T_6 - 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application + vermicompost @ 4 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT. T_7- 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50 % $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT. The experiment was laid out in Randomized Block Design (RBD) and replicated three times. The recommended dose of fertilizers *viz.,* 150:100:50 kg N: P_2O_5: K_2O ha^{-1} was applied uniformly to all plots. The growth attributes *viz.,* plant height was recorded on 25, 50 and 75 days after transplanting. The number of branches was recorded 40 days after transplanting, number of flowers was recorded 60 days after transplanting and number of fruits was recorded 80 days after transplanting. The stover and fruit yield were recorded at harvest. The titrable acidity, ascorbic acid and total soluble solid content were also estimated in the fruits at harvest stage. The nutrient uptake *viz.,* N, P, K, Ca, Mg, S, Zn and B by plant, stover and fruit at harvest were computed from the dry matter production recorded and the stover and fruit yield and their nutrient contents (N, P, K, Ca, Mg, Zn and B). The available nutrient status of the post harvest soil was also analyzed. The above soil and plant sample was collected periodically and analysis for standard procedures and experimental data were processed statistical analysis followed.

EXPERIMENTAL RESULTS AND DISCUSSION

The present investigation was under taken to find out the Application of enriched vermicompost with micronutrients and foliar spray on tomato (cv. PKM-1) on growth components, yield and quality in saline soil (Table-2).

Physico – chemical properties of initial soil

The initial soil collected from the exprerimental field was analysed for the physico – chemical properties and the results are furnished in Table 1.

The soil of Theerthampalayam Village was found to contain 48.9, 22.4 and 27.9 per cent sand, silt and clay respectively and come under the textural class sandy loam. The bulk density, Particle density, pore space, pH, electrical conductivity and contain exchange capacity of the soil were 1.20, 2.03 Mg m^{-3}, 45.0 per cent and 8.41, 4.02 dS m^{-1} and 15.20 cmol (p^+) kg^{-1} respectively. The organic carbon content of soil was 6.8 g kg^{-1}. The available N, P and K content of soil was 216.0, 9.0 and 150.7 kg ha^{-1} respectively. The available sulphur content was 12.5 mg kg^{-1}. The exchangeable Calcium, Magnesium, Potassium and Sodium content were 5.3, 2.9, 3.2 and 3.8 cmol (p^+) kg^{-1} respectively. The available Micronutrients Zn, Fe, Mn, Cu and B content of Soil was 0.67, 1.45, 1.67, 0.24 and 0.29 mg kg^{-1} respectively.

Table 1 Physico – Chemical Properties of initial soil

I	**Physical Properties**	**Contents**
	Mechanical analysis	
a)	Sand (%)	48.90
	Silt (%)	22.40
	Clay (%)	27.90
	Textural Class	Sandy Loan
	Bulk density(Mg m^{-3})	1.20
	Particle density(Mg m^{-3})	2.03
	Pore Space (%)	45.0
II	**Physico-Chemical properties**	
1)	pH	8.41
2)	EC (dS m^{-1})	4.02
3)	Organic Carbon(g kg^{-1})	6.80
4)	CEC cmol (p^+) kg^{-1}	15.20
5)	**Available Macronutrients**	
I	Alkaline $KMnO_4$ (kg ha^{-1})	216.0

Ii	Olsen's-p (kg ha^{-1})	9.0
Iii	NH_40AC- K (kg ha^{-1})	150.70
Iv	Available Sulphur (mg kg^{-1})	12.50
6)	**Available micro nutrients**	
A	DTPA – Zn (mg kg^{-1})	0.67
B	DTPA – Fe (mg kg^{-1})	1.45
C	DTPA – Mn (mg kg^{-1})	1.67
D	DTPA – Cu (mg kg^{-1})	0.24
E	Hot Water – B (mg kg^{-1})	0.29
7)	**Exchangeable Cations**	
A	Ca cmol (p^+) kg^{-1}	5.30
B	Mg cmol (p^+) kg^{-1}	2.90
C	Na cmol (p^+) kg^{-1}	3.80
D	K cmol (p^+) kg^{-1}	3.20

Growth Characters

Among the different treatments tried, application of 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT (T_7) significantly increased the growth components *viz*., Plant height (25, 50 and 75 DAT), number of branches (40 DAT) and number of flowers $plant^{-1}$ (60 DAT) respectively. Regarding the growth attributes, the best treatment was T_7 (10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT).

enhancement in photosynthetic and other metabolic activities, which lead to an increase in plant metabolism. It was observed that soil application of boron enhanced the number of fruits $plant^{-1}$ and single fruit weight Sathya *et al*. (2010).The increased fruit yield due to organic manures might be attributed to supply of micronutrients, N, P, K are slow release nutrients all over the growth season, moreover, organic manure is rich in its nitrogen. These favourable conditions create better nutrients absorption. Consequently higher total yield would be obtained by enriched organic manures Glala *et al*. (2013).

The highest fruit and stover yield might be due to optimum Boron application, boron plays important role in maintaining cell integrity, improving respiration, enhancing metabolic activities and uptake of nutrients Raja Mohib Mazzam Naz *et al*. (2012).Tomato fruit yield was affected significantly by applying of enriched organic manures with micronutrients leading to increase fruit and stover yield. The highest fruit and stover yield was recorded by the application of enriched organic manures Prativa and Bhattari (2011).

Table 2 Effect of enriched vermicompost with micronutrients and foliar spray on growth, yield and quality in tomato

Treatment details	Plant Height(cm)			Number of branches $plant^{-1}$	Number of flowers $plant^{-1}$	Number of fruit $plant^{-1}$	Single fruit weight (gm)	Stover yield (kg ha^{-1})	Fruit yield (q ha^{-1})	Titrable acidity (%)	Ascorbic acid (mg $100g^{-1}$)
	25 DAT	50 DAT	75 DAT								
T_1 –	14.16	29.10	34.4	6.99	23.00	15.00	70.94	1241.33	295.73	0.76	30.35
T_2 –	20.56	37.50	42.10	10.62	27.33	18.27	78.00	1548.33	395.06	0.71	35.69
T_3 –	27.40	47.90	52.80	13.78	31.22	19.48	85.54	1969.66	461.65	0.65	38.47
T_4 –	34.10	54.20	63.13	16.3	36.00	20.19	92.84	2453.33	520.23	0.58	41.20
T_5 –	27.96	48.0	52.86	13.63	30.33	19.70	84.95	1996.33	463.4	0.64	38.37
T_6 –	40.46	60.16	72.86	18.09	39.00	22.34	94.52	2733.66	585.81	0.50	43.21
T_7 –	47.38	65.00	82.20	22.53	46.50	25.22	98.00	3142.33	684.25	0.41	45.40
S.Ed.	1.79	3.40	4.80	1.13	1.77	0.82	6.50	119.50	24.04	0.01	1.98
CD (p = 0.05)	3.91	5.06	8.11	1.99	3.05	2.51	7.09	260.38	52.39	0.03	4.25

The highest plant height 47.38, 65.0 and 82.20 cm on 25, 50 and 75 DAT, Number of branches $plant^{-1}$ of 22.53 was recorded at 40 DAT and number of flowers $plant^{-1}$ of 46.50 was recorded at 60 DAT respectively in the same treatment.

Yield Attributes and Yield

Among the different treatments tried, application of 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT significantly increased the yield attributes *viz*., number of fruits $plant^{-1}$, single fruit weight, fruit volume, fruit density, fruit yield and Stover yield. Application of (10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT) T_7 registered maximum number of fruits $plant^{-1}$ 25.22, single fruit weight of 98.0 gm on 80 DAT, fruit volume 62.27 (cc) and fruit density 1.57 (g cc^{-1}) respectively. The maximum fruit yield of 684.25 q ha^{-1} and Stover yield of 3142.33 kg ha^{-1} was recorded in the treatment T_7 (10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT). This was followed by T_6 (10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application + vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT). The yield of tomato significantly increased besides, reducing the fruit cracking. The improvement in plant growth might be due to

Application of 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} +0.50% $ZnSO_4$ + 0.40% borax as F.S on 45 and 60 DAT (T_7) shows the lower titrable acidity (Fig.5). The enhanced absorption of added N and also due to synergestic effects of N and boron in soil and crops. Boron involved in regulations of carbohydrates balance and helped to decrease the titrable acidity (Sathya *et al*., 2010). Titrable acidity decreased with increasing levels of boron application. The ascorbic acid content of the fruit due to the boron and zinc levels. Ascorbic acid of fruit improves with zinc sulphate and borax @ 10 and 20 kg ha^{-1}, respectively (Salam *et al*., 2011).

CONCLUSION

It is clear from the present investigation for the saline soil, the best combination is 10 kg of $ZnSO_4$ + 2.5 kg of borax as soil application enriched with vermicompost @ 4 t ha^{-1} + 0.50% of $ZnSO_4$ + 0.40% of borax as F.S on 45 and 60 DAT (T_7). Therefore for successful and profitable crop production there would be needed to supply Zn and B from fertilizers, especially for the saline soil in tomato crop. As organic manures (vermicompost) is quite important for supply of micronutrients, farmers of the district should be encouraged to apply bio fortification with micronutrients along with balanced use of fertilizers boosting the production of fruit yield and quality of tomato crop in saline soil.

References

Anonymous. 2008. FAO land and plant nutrition management service. http://www.fao.org/ag/agl/agll/spush.

Glala, A.A.A., Neama Marzouk, M.S.S. Al-Bassyuni and Nagwa. 2013. Influence of organic Nitrogen fertilizers replacement rates associated with azospirillum spp, enrichment on tomato. *J. Applied. Sci. Res*., 3: 1952-1959.

FAO. 2013. Quarterly bulletin of statistics. Food and organization of United Nations.

Flowers, T.J, P.M. Gaur, C.L. Laxmipathi Gowda, L. Krishnamurthy, S. Samineni, K.H.M. Siddique, N.C. Turner, V. Vadez, R.K.Varshney and T.D. Colmer. 2010. Salt sensitivity in chickpea. *Plant, Cell & Environ.,* 33: 490-509.

Kumar. M. and Babel, A.L. 2011 Available micronutrient status and their relationship with soil properties of Jhunjhunu tehsil, Jhunjhunu, Rajasthan. Indian. *J. Agric. Sci.,* 3: 97-106.

Mioli Mandal, Niwar Ranjan Roy, Dabarihis Mazumdar and Dilip kumar Das. 2009. Effect of different sources of boron on its maintenance in soil in relation to rape, *Arch. of Agron. and Soil Sci.,* 4: 247-253.

Munns, R. and M. Tester. 2008. Mechanism of salinity tolerance. *Annl. Rev. Plant Biol.,* 59: 651-681.

Namasivayam, N.2014. Productionftomao. Kissanworld. May2004. Pp.56-60.

Prativa, K.C. and Bhattarai. B.P. 2011. Effect of integrated nutrient management on the growth, yield and soil nutrient status in tomato. *Nepal. J. Sci. Tech.* 12: 23-28.

Raja Mohib Mazzam Naz, Sher Muhammad, Abdul Hamid and Farida Bibi. 2012. Effect of boron on the flowering and fruitingoftomato.*Sarhad .J. Agric.,* 28:124-129.

Sathya, S., S. Mani, P.P. Mahendran and Arulmozhiselvan. K. 2010. Effect of application of boron on growth, quality and fruit yield of PKM-1 tomato. *Indian. J. Agric. Res.,* 44: 280.

Salam, M.A., M.A. Siddique, M.A. Rahim, M.A. Rahman and M.A. Goffar. 2011 Quality of tomato as influenced by boron and zinc in presence of different doses of cowdung. *Bangladesh J. Agric. Res.,* 36: 151-163.

Velu, V., Mathew. Usha and Baskar, A. 2008. Scenario of micro and secondary nutrient deficiencies in the states of Tamil Nadu, Kerala and Pondicherry and amelioration practices for increasing crop production and ensuring food security. Paper presented in the National seminar on Micro and Secondary Nutrients for Balanced Fertilization and Food Security. March 11-12, AAU, Anand, Gujarat.

How to cite this article:

Senthilkumar N (2018) 'Enriched Vermicompost with Micronutrients and Foliar Spray on Tomato (cv. Pkm-1) Boosting Yield and Quality in Saline soil', *International Journal of Current Advanced Research,* 07(10), pp. 15799-15802.
DOI: http://dx.doi.org/10.24327/ijcar.2018.15802.2897

****