Int.J.Curr.Microbiol.App.Sci (2018) *7*(3): 601-608

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 03 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.703.071

Effect of Micronutrient Application on Growth and Yield of *Kharif* Onion (*Allium cepa* L.)

Pankaj Kumar Maurya*, Lal Mani Yadav, Ghanshyam Thakur and Pushpam Patel

Department of Horticulture, DRPCAU, Pusa, Samastipur, Bihar- 848125, India

**Corresponding author*

Keywords

Onion, RDF, $ZnSO_4$, $FeSO_4$, Borax, Growth and yield

Article Info

Accepted:
07 February 2018
Available Online:
10 March 2018

A B S T R A C T

Onion is one of the most important bulb crop grown all over the world. Onion belongs to family 'Amaryllidaceae" and locally known as Pyaj. The experiment was carried out during *Kharif* season of 2016-2017 at Tirhut College of Agriculture Dholi experimental farm, Dholi (Muzaffarpur), a campus of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar. The experiment was laid out in RBD (Randomized Block Design) with ten treatments and three replication. The crop was planted in a plot (size 3m × 2m) at a spacing of 15 cm × 10 cm. The observations recorded on at 30, 45 and 60 DAT of plant height and number of leaves per plant, average weight of bulb per plant, A grade bulb, B grade bulb, marketable bulb yield, marketable bulb percentage, total bulb yield was recorded. In treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50kg/ha). The maximum polar and equatorial diameter was recorded in treatment T_6 (NPKS + soil application of Borax @ 15 kg/ha).The lowest collar thickness at 30, 45 and 60 DAT, neck thickness, doubler bulbs, bolters and C grade bulb was found in treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50kg/ha). Results were found to be significant in most of the growth and yield contributing parameters of *Kharif* onion.

Introduction

Onion (*Allium cepa* L.) is a versatile food source due to its unique flavour and odour. It adds taste to many dishes in the form of vegetables as well as spice. It's the unique ingredient of the dishes common among rich to the poor man's meal. Onion is rich in sulphur containing compounds that are responsible for pungent odour with health promoting effects. It contains anti-inflammatory, anti-cholesterol, anti-cancer and anti-oxidant components, such as quercetin. Onion belongs to family 'Amaryllidaceae" and locally known as Pyaj. It is old world crop and it was domesticated in Iran and Pakistan i.e. Central Asia. This crop can be grown in wide range of Agro-climate condition. Irrespective of prices, the demand remain almost constant in the market as it is primarily, used as seasoning for a wide variety of dishes in almost every home, widely consumed as salad as culinary purpose for flavouring as spice in pickles and sauce. The green leaves, immature and mature bulbs are eaten raw or used in vegetable preparations. Nutritive value of onion varies variety to variety, small size onions are more nutritive

than big size, and its major value is flavour. Onion ranks medium in caloris low in protein and very low in Vitamins. Onion accounts for 70 percent of our total foreign exchange earnings from the export of fresh vegetables. Now a day's government of India has declared Onion as an essential commodity.

Micronutrients are equally important like major nutrients for crop grow the developments are used in smaller quantities. The micronutrients required by plants are iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B), molybdenum (Mo), chlorine (Cl) and nickel (Ni). The availability of these nutrients in soil depends on the soil and the environment. For example, cool weather and wet soil conditions reduce the availability of Zn, resulting in a Zn deficiency. Micronutrient availability (except Mo) generally decreases as soil pH increases. Availability of Zn, Mn and Cu declines rapidly as soil pH rises; in sandy soils micronutrient deficiencies is more than clay soils.

Micronutrients also help to increase the efficiency of macronutrients. Unfortunately micronutrients have received less attention in fertilizer management research, development and extension. Growers should carefully follow recommendations for micronutrients to avoid unnecessary costs and possible toxic effects or deleterious interactions with other nutrients. Selection of an effective application method depends on the micronutrient need, local soil conditions, and the stage of crop growth, growing season at which a deficiency is detected. Fertilizers can increase yield and quality of crop produce. Looking at the importance of micronutrient application in onion to increase its yield, an experiment was planned and conducted on "Effect of Micronutrient Application on Growth and Yield of *Kharif* Onion (*Allium Cepa* L.) during *kharif* onion production in calcareous soil of North Bihar".

Materials and Methods

The experiment was carried out during *Kharif* season of 2016-2017 at Tirhut College of Agriculture Dholi kothi farm, Dholi (Muzaffarpur), a campus of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar. The experiment was laid out in a RBD (Randomized Block Design) with ten treatments and three replication. The crop was planted in a plot (size 3m × 2m) at a spacing of 15 cm × 10 cm. Before fertilizer application, random soil samples were taken from the experimental field and were analysed.

The experimental field soil is sandy loam with alkaline pH 8.40, low in soil organic carbon (0.46%), electrical conductivity (0.36 ds m^{-1}), available nitrogen (226 kg/ha), available phosphorus (16.0.9 kg/ha), potash (115.60 kg/ha), available boron (0.26 ppm) and zinc (0.84 ppm) and iron (9.06 ppm). The soil is deficient in available boron. Hence the soil application and foliar application of micronutrient at 30 and 45 DAT as zinc sulphate for zinc, borax for boron and ferrous sulphate for iron was used as experimental material.

The treatments includes T_1(NPKS), T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha), T_3 (NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha), T_4 (NPKS+ foliar application of $ZnSO_4$ @ 0.5% at 30 and 45 DAT), T_5 (NPKS+ soil application of Borax @ 10 kg/ha), T_6 (NPKS+ soil application of Borax @ 15 kg/ha), T_7 (NPKS+ foliar application of Borax @ 0.25 % at 30 and 45 DAT),T_8 (NPKS+ soil application of $FeSO_4$ @ 25 kg/ha), T_9 (NPKS+ soil application of $FeSO_4$ @ 50 kg/ha), T_{10} (NPKS+ foliar application of $FeSO_4$ @ 1% at 30 and 45 DAT) replicated thrice in a RBD. Five plants were selected from each plot randomly as a unit for observation on growth aspect and yield attributes.

Results and Discussion

Growth parameters include plant height (cm), number of leaves/plant and collar thickness (cm) is observations recorded at 30, 45 and 60 DAT.

Plant height

The application of micronutrient on plant height of onion was recorded significant effect at 30 and 45 DAT over control. No significant differences were detected on plant height at 60 DAT. The highest plant height 39.60 cm, 48.20 cm and 52.60 cm were recorded with T_3 (NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha) at all the three stages of data recorded and minimum plant height 27.00 cm, 32.47 cm and 1.80 cm with T_1 (control). These finding are in agreement with the finding of Manna and Maity (2016) and Aske *et al.,* (2017) in Onion crop. Zinc as an essential catalyst in the synthesis of auxin from tryptophan would have encouraged auxin biosynthesis in the active sinks which would have led to higher transport and accumulation of photosynthates in foliage (Table 1).

Number of leaves per plant

There was significant effect of micronutrient application on number of leaves/plant which varied from 3.23 to 5.13, 3.87 to 5.80 and 5.50 to 7.60 at 30, 45 and 60 DAT, respectively. The highest number of leaves/plant (5.13) was recorded in treatment T_3 (NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha) at 30 DAT followed by treatment T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha) whereas lowest no. of leaves/plant 3.23 at 30 DAT was noted in treatment T_1 (control). At 45 DAT the highest number of leaves/plant (5.80) was recorded in treatment T_3 (NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha) followed by treatment T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha while lowest number of leaves/plant (3.87) at 45 DAT was recorded in treatment T_1 (control). The maximum number of leaves/plant (7.60) was found in treatment T_3 (NPKS+ Soil application of $ZnSO_4$ @ 50 kg/ha) at 60 DAT followed by treatment T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha) whereas minimum number of leaves/plant (5.50) at 60 DAT was noted in treatment T_1 (control). Similar result was reported by Paul *et al.,* (2007), Shukla *et al.,* (2015) and Acharya *et al.,* (2015) in Onion crop. This may be because of better growth and development of foliage under higher balanced nutritive environment.

Collar thickness (cm)

The significant effects of micronutrient application on collar thickness were measured. Collar thickness ranges from 0.20 to 0.44 cm, 0.37 to 0.78 cm and 1.03 to 1.72 cm at 30, 45 and 60 DAT, respectively. The minimum collar thickness at 30, 45 and 60 days after transplanting were recorded with T_3(NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha) and maximum collar thickness 0.44 cm, 0.78 cm and 1.72 cm with control respectively.

Yield parameter includes neck thickness (cm), polar diameter (cm), equatorial diameter (cm), A grade bulb (%), B grade bulb (%), average bulb weight C grade bulb (%), Bolters (%), Doubles (%), marketable bulb (%), marketable bulb yield (t/ha) and total bulb yield (%) were also recorded.

Neck thickness (cm)

The effect of micronutrient on neck thickness also had significant effect and significantly low neck thickness was (1.43 cm) recorded with T_3 (NPKS+ soil application of ZnSO4 @ 50 kg/ha) followed by T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha).The highest neck thickness (1.95 cm) was recorded in treatment T_1 (control) (Table 2).

Table.1 Effect of micronutrient application on plant height, no. of leaves and collar thickness of *Kharif* onion

Treat. Symb.	Plant height (cm)			No. of leaves per plant			Collar thickness (cm)		
	30DAT	45DAT	60DAT	30DAT	45DAT	60DAT	30DAT	45DAT	60DAT
T_1	27.00	32.47	41.80	3.23	3.87	5.50	0.44	0.78	1.72
T_2	36.40	46.73	51.33	4.93	5.67	7.20	0.26	0.55	1.05
T_3	39.60	48.20	52.60	5.13	5.80	7.60	0.20	0.37	1.03
T_4	32.20	39.07	48.47	4.00	5.03	6.20	0.41	0.71	1.38
T_5	34.87	43.67	50.33	4.53	5.53	6.67	0.32	0.58	1.08
T_6	35.80	45.87	51.07	4.73	5.60	7.07	0.27	0.57	1.07
T_7	31.27	38.87	48.27	3.97	4.87	6.00	0.41	0.76	1.43
T_8	33.73	41.73	49.13	4.33	5.20	6.37	0.36	0.61	1.37
T_9	33.87	42.77	50.27	4.47	5.33	7.40	0.43	0.60	1.36
T_{10}	30.20	36.77	47.60	3.87	4.60	5.93	0.42	0.77	1.53
S.Em±	1.74	1.93	2.29	0.22	0.24	0.39	0.02	0.03	0.06
C.D. (P=0.05)	5.21	5.77	NS	0.66	0.72	1.16	0.06	0.09	0.19

Table.2 Effect of micronutrient on yield attribute of *Kharif* onion

Treat. Symb.	Neck thickness (cm)	Polar diameter of bulb (cm)	Equatorial diameter of bulb (cm)	Bolters (%)	Doubles bulb (%)	Average weight of bulb (g)
T_1	1.95	2.40	2.24	3.67	2.67	148.11
T_2	1.63	3.95	3.66	2.73	1.43	217.66
T_3	1.43	3.99	3.74	2.17	1.02	233.33
T_4	1.90	3.58	3.32	3.33	1.58	172.22
T_5	1.70	4.04	3.76	2.91	1.45	181.11
T_6	1.68	4.30	4.05	2.87	1.43	193.33
T_7	1.92	3.66	3.38	3.37	2.25	170.55
T_8	1.83	3.76	3.46	3.17	1.48	176.11
T_9	1.72	3.83	3.55	3.00	1.47	179.22
T_{10}	1.93	3.51	3.23	3.42	2.63	167.22
S.Em±	0.08	0.20	0.25	0.15	0.08	8.64
C.D (P=0.05)	0.25	0.60	0.75	0.44	0.24	25.86

Table.3 Effect of micronutrient on marketable bulb yield of *Kharif* onion

Treat. Symb.	A grade bulb (%) Diameter (<5.0 cm)	B grade bulb (%) Diameter (3.0 cm – 5.0 cm)	C grade bulb (%) Diameter (>3.0 cm)	Total bulb yield (t/ha)	Marketable Bulb yield (t/ha)	Marketable Bulb (%)
T_1	25.17	12.67	24.00	17.17	16.44	51.92
T_2	52.33	20.33	12.33	23.94	23.23	80.08
T_3	53.75	20.92	11.08	24.61	24.10	89.67
T_4	37.67	14.75	18.08	18.83	17.94	63.92
T_5	43.27	19.25	12.75	18.94	18.22	71.35
T_6	47.00	19.83	12.50	20.11	19.99	72.12
T_7	37.53	14.50	18.25	18.00	17.06	56.75
T_8	37.83	17.50	14.75	18.61	18.08	64.08
T_9	38.00	18.00	13.02	18.83	18.05	68.17
T_{10}	35.75	14.42	23.50	17.83	17.00	52.58
S.Em±	1.89	1.06	1.22	1.54	1.47	4.70
C.D (P=0.05)	5.67	3.18	3.66	4.60	4.40	14.07

In rapport of this result the following workers have also reported the same trend in respective onion crops Mukesh Kumar *et al.*, (1998), Shrinath (2004) on onion. The application of zinc might have reduced the moisture content and reduced the bulb neck thickness.

Polar and equatorial diameter (cm)

The application of micronutrient shows significant effect on the bulb polar diameter and equatorial diameter in *kharif* onion. Polar diameter of bulb ranging from 2.40 cm to 4.30 cm and maximum with T_6 (NPKS+ soil application of Borax @ 15 kg/ha) and minimum with T_1 (Control). The same trend has recorded in case of equatorial diameter of bulb also. The range was 2.24 cm to 4.05 cm. minimum was with T_1 (Control) and maximum with T_6 (NPKS+ soil application of Borax @ 15 kg/ha). Similar results were also reported by Smiriti *et al.,* (2002), Tohamy *et al.,* (2009), Alam *et al.,* (2010), Shukla *et al.,* (2015), Aske *et al.,* (2017) in onion. This may be due to the micronutrient application especially boron which enhances the enzyme activity which in turn trigger the physiological processes like protein and carbohydrate metabolism in plants.

Bolter bulbs (per cent)

Significant differences were also recorded for bolter bulbs and lowest percentage of bolter bulbs (2.17 per cent) was recorded with treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha and maximum bolter bulb (3.67 per cent) recorded in treatment T_1 (Control). However, all the treatments of micronutrients were found superior over control except T_4, T_7 and T_{10}. Shrinath, B.M (2004) also has reported the similar results.

Doubler bulbs (per cent)

Significantly low percentage of doubler bulbs were recorded in all treatments except T_{10} as

compared to control T_1. Minimum doubler bulb (1.02 per cent) was recorded in treatment T_3 (NPKS+ soil application of $ZnSO_4$ @ 50 kg/ha) and maximum doubler bulb (2.67 per cent) was found in treatment T_1 (Control). Shrinath (2004) have also reported in onion crop.

Average weight of bulb (g)

Application of micronutrients had positive significant effect on average bulb weight as compared to T_1 (control). The maximum bulb weight (233.33 g) was recorded with T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) which was statistically at par with T_2 (NPKS+ soil application of $ZnSO_4$ @ 25 kg/ha), while minimum bulb weight (148.11 g) was recorded in treatment T_1 (control). However, all the treatments of micronutrients were found superior over control, except T_4, T_7 and T_{10}. The present results corroborate with Paul *et al.,* (2007), Abedin *et al.,* (2012), Trivedi and Dhumal (2013), Manna *et al.,* (2014), Karthik (2015) and Manna and Maity (2016) and Aske *et al.,* (2017) in onion crop. They have reported that zinc rapidly increases the photosynthetic activity and translocation of photosynthates for growing onion bulbs and it influenced the bulb weight positively.

'A' grade bulb (per cent)

'A' grade bulb differed significantly due to different treatments. The highest 'A' grade bulb (53.75 per cent) was recorded in treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) which was statistically at par with T_2 (NPKS + soil application of $ZnSO_4$ @ 25 kg/ha) and T_6 (NPKS + soil application of Borax @ 15 kg/ha) whereas lowest A grade bulb (25.17 per cent) found in treatment T_1 (Control). However, all the treatments were found significantly superior over control. Lal *et al.,* (2002), Trivedi and Dhumal (2013), Manna (2013) and Karthik (2015) also has reported the similar results. This might be due to the influence of zinc on the photosynthesis, which might induce more starch and sugar production.

'B' grade bulb (per cent)

Treatments have significant effect on 'B' grade bulb. The highest B grade bulb (20.58 per cent) was recorded in treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) followed by T_2 (NPKS + soil application of $ZnSO_4$ @ 25 kg/ha) while lowest B grade bulb (12.67 per cent) were recorded in treatment T_1 (Control). However, all the treatments of micronutrients were found superior over control except T_4, T_7 and T_{10}. Similar results have been reported by Lal *et al.,* (2002), Trivedi and Dhumal (2013), Manna (2013) and Karthik (2015). This might be due to the influence of zinc on the photosynthesis, which might induce more starch and sugar production under balanced fertilizer application.

'C' grade bulb (per cent)

In case of 'C' grade bulb significant differences were recorded due to different treatment. The lowest C grade bulb (9.08 per cent) was recorded in treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) followed by T_2 (NPKS+ soil application of $ZnSo_4$ @25 kg/ha) whereas highest C grade bulb (24.0 per cent) was recorded in treatment T_1 (Control). Similar result was reported by Shrinath (2004) and Manna (2013).

Marketable bulb (per cent)

The treatment T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) recorded maximum marketable bulb (89.67 per cent) and recorded at par with treatment T_2 (NPKS + soil application of $ZnSO_4$ @ 25 kg/ha). The lowest marketable bulb (51.92 per cent) was recorded in T_1 (Control).

Marketable bulb yield (t/ha)

Marketable bulb yield varied from 16.44 to 24.10 t/ha. T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) gave maximum marketable bulb yield (24.10 t/ha) which was at par to T_2 (NPKS + soil application of $ZnSo_4$ @ 25 kg/ha) and T_6 (NPKS + soil application of Borax @ 15 kg/ha) and these were significantly superior over control (16.44 t/ha).). The result related to marketable yield with the finding of Mukesh *et al.,* (2000), Khan *et al.,* (2007), Dake *et al.,* (2011), Manna *et al.,* (2014), Manna and Maity (2016) and Aske *et al.,* (2017) in onion (Table 3).

Total bulb yield (t/ha)

Maximum total bulb yield (24.61 t/ha) recorded with T_3 (NPKS + soil application of $ZnSO_4$ @ 50 kg/ha) which is statistically at par with treatment T_2 (NPKS + soil application of $ZnSo_4$ @ 25 kg/ha) and T_6 (NPKS + soil application of Borax @ 15 kg/ha) while lowest bulb yield (15.83 t/ha) was recorded with T_1 (control). These finding are in agreement with the finding of Gamelli (2000), El- Shafie and El- Gamaily (2002), Alam *et al.,* (2010), Ballabh and Rana (2012), Manna *et al.,* (2014) and Manna and Maity (2016) in onion. They reported that zinc rapidly increases the photosynthetic activity and translocation of photosynthates to growing onion bulbs, so that it influenced the bulb weight positively.

Analysis of variance revealed highly significant difference among the treatments for all the characters studied except plant height at 60 DAT.

Maximum plant height, number of leaves per plant, average weight of bulb/ plant, A grade bulb, B grade bulb, total bulb yield, marketable bulb yield, marketable bulb was recorded in NPKS + soil application of $ZnSO_4$ @ 50kg/ha. Minimum collar thickness, neck thickness, bolters, doubler bulb and C grade bulb was recorded in NPKS + soil application of $ZnSO_4$ @ 50kg/ha. Maximum polar and equatorial diameter was observed in NPKS + soil application of Borax @ 15 kg/ha

References

Abedin, M.J., Alam, M.N., Hossain, M.J., Ara, N.A and Haque. K.M.F. (2012). Effect of micronutrients on growth and yield of onion under calcareous soil environment. *International Journal of Biosciences* .2(8): 95-101.

Acharya, U., Venkatesan, K., Saraswathi, T. and Subramanian, K.S. (2015). Effect of zinc and boron application on growth and yield parameters of multiplier onion (*Allium cepa* L.*var.* aggregatum Don.) var. CO (On)5. *International Journal of Research* 2 (1): 757-765.

Alam, M.N., Abedin, M.J. and Azad, M.A.K. (2010). Effect of micronutrients on growth and yield of onion under calcareous soil environment. *International Research Journal of Plant Science* 1 (3): 56-61.

Aske Vijay, Jain, P.K., Lal, N. and Shiurkar, G. (2017). Effect of Micronutrients on Yield, Quality and Storability of Onion cv. Bhima Super. *Trends in Biosciences*10 (6):1354-1358.

Ballabh, K and Rana, D.K. (2012). Response of micronutrients on qualitative and quantitative parameters of onion (*Allium cepa* L.). *Progressive Horticulture.* 44(1): 40-46.

Dake, S. D., Hiwale, B. G., Patil, V. K. and Naik, P. G. (2011). Effect of micronutrients on growth, yield and quality of onion (*Allium cepa* L.) cv. Baswant 780. In: Proceedings of National Symposium on Alliums: Current Scenario and Emerging Trends. Pune, India: VAMNICOM.

El-Shafie, Fatma, S. and Elida, E. El-Gamaily. (2002). Effect of organic manure, sulphur and microelements on growth, bulb yield, storability and chemical composition of onion plants. *Minufiya. Journal of*

Agriculture Research. 27(2): 407-424.

Gamelli, E.L., Hanna, H., Hadi, E.L. (2000) The effect of some foliar fertilizers application on growth, bulb yield, quality and storage ability of Giza 20 onion cultivar (*Allium cepa*L). *Annals of Agril. Sci. Moshtohor*., 38(3): 1727-1737.

Goyal, R. (2015). Effect of foliar application of micronutrients on growth and yield of Onion (*Allium cepa* L.) c.v. Agrifound dark red". *M.sc thesis*. RajmataVijayarajeScindiaKrishiVishwaVidyalaya Gwalior (M.P.)

Kartik, P. (2015). Effect of micronutrients on growth, yield and quality of onion. M.Sc Thesis, Orissa University of Agriculture and Technology, Orissa.

Khan, A.A, Zubair, M., Bari, A. and Maula. (2007).Response of onion (*Allium cepa L.*) growth and yield to different levels of nitrogen and zinc in swat valley. *Sarhad Journal Agriculture.* 23(4): 933-936.

Lal, S., Yadav, A. C., Mangal, J.L., Singh, A. and Batra, V. K. (2002). Effect of FYM and irrigation levels on growth and yield of onion cv. *Hisar-2*. *Haryana Journal of Horticulture science.* 31(3 and 4): 256-258.

Manna, D. (2013). Growth, yield and bulb quality of onion (*Allium cepa* L.) in response to foliar application of boron and zinc. *SAARC Journal of Agriculture.* 11(1): 149-153.

Manna, D. and Maity, T.K. (2016). Growth, yield and bulb quality of onion (*Allium cepa* L.) in response to foliar application of boron and zinc. *Journal of Plant Nutrition*, 39(3): 438-441.

Manna, D., Maity, T.K. and Ghosal, A. (2014). Influence of foliar application of boron and zinc on growth, yield and bulb quality of onion (*Allium cepa*L.). *Journal of Crop and Weed*10 (1): 53-55.

Mukesh K., Das, D.K., Chattopadhyaya, T.K. and Kumar, M. (2000). Effect of zinc and sulphur application on the storage of rabi onion under different methods of storage. *Environment and Ecology*. 18(2): 311-316.

Paul,J.K., Halder, B.C. and Khan, M.A. (2007). Effects of boron and sulphur on the growth and yield of onion (*Allium cepa* L.*). Journal science of technology (Dinajpur)* (5): 60-66.

Shrinath, B. M. (2004). Studies on effect of foliar application of calcium and zinc on yield and keeping quality of onion bulbs *(Allium Cepa* L.) Cv. S_1 (Phule Samarth). *M.Sc Thesis.*

Shukla, L., Bose, U.S. and Ahirwar, M.K. (2015). Effect of foliar feeding of micronutrients on growth, yield and income from *rabi* onion var. *Agrifound Light Red*. *Annals of Plant and Soil Research.*17(3): 307-310.

Smiriti, S., Kumar, R. and Singh, S.K. (2002). Effect of sulphur and boron nutrition on growth, yield and quality of onion (*Allium cepa* L.) Patna. *Indian Journal of Applied Biol*ogy. 12(1/2): 40-46.

Tohamy, W.A., Khalid, A.K., Abagy, H.M. and Hussein, S.D. (2009). Essential oil, growth and yield of onion (*Allium cepa* L). In response to foliar application of some micronutrients. *Australian Journal of Basic and Applied Sciences.* 3(1): 201-205.

Trivedi, A.P and Dhumal, K.N. (2013). Effect of soil and foliar applications of zinc and iron on the yield and quality of onion (*Allium cepa* L.). *Bangladesh Journal of Agricultural Research*. 38 (1): 41-48.

How to cite this article:

Pankaj Kumar Maurya, Lal Mani Yadav, Ghanshyam Thakur and Pushpam Patel. 2018. Effect of Micronutrient Application on Growth and Yield of Kharif Onion (*Allium cepa* L.). *Int.J.Curr.Microbiol.App.Sci.* 7(03): 601-608. doi: https://doi.org/10.20546/ijcmas.2018.703.071