Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5217

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 660-665 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Influence of Foliar Spray of Micronutrient Formulation on Quality and Shelf Life of Potato (*Solanum tuberosum* L.)

Manjunath, R. P.*, Vishnuvardhana, Anjanappa, M., Ramegowda, G. K., Anilkumar, S. and Prasad, P. S.

Department of vegetable Science, College of Horticulture, UHS Campus, GKVK Post, Bengaluru-560065
University of Horticultural Sciences Bagalkot-587104, Karnataka, India

*Corresponding Author E-mail: manjuphort@gmail.com

Received: 15.07.2017 | Revised: 22.08.2017 | Accepted: 28.08.2017

ABSTRACT

A field experiment was conducted at Horticulture Research and Extension Centre, Somanahallikaval, Hassan during 2016 to study the effect micronutrient formulationson quality and shelf life of potato cv. KufriJyoti. The experiment was conducted with Randomized Complete Block Design with twelve treatments randomized thrice.Treatments included were T_1 (control)- RDF (FYM 25 t/ha + N:P:K at 75:75:100 kg/ha), T_2 – T_1+ boron, T_3 -T_1+ zinc, T_4 - T_1 + zinc + boron, T_5 - T_1 + IIHR vegetable special, T_6 - T_1 + IIHR potato special, T_7 - T_1 + UHSB 1, T_8 - T_1 + UHSB 2, T_9 - T_1 + UHSB 3, T_{10} - T_1 + UHSB 4, T_{11} - T_1 + UHSB 5, and T_{12} - RDF of N:P:K without FYM. Micronutrients formulation were sprayed at 30, 45 and 60 DAS.Among those,foliar spray of UHSB-3 micronutrient formulation + RDFrecorded significantly highest dry matter (19.76%), total sugar (0.43%), least rotten tubers (31.62%)compared to control. Delayed tuber rotting (33 days) was recorded by foliar spray of UHSB-1 micronutrient formulation. Further foliar spray of IIHR vegetable special and UHSB-2 micronutrient formulation recorded significantly highest reducing sugars (0.40%), However foliar spray of UHSB-5 micronutrient formulations recorded significantly lowest physiological weight loss (46.25% , 75 days after storage)and least PTM infested tubers (28.40%, 33.65% at 30 and 45 days respectivelyafter storage). Average PTM tunnels per tuber during storage was significantly lowest in foliar spray of IIHR vegetable special at 30 45 and 60 DAS.

Key words: *Micronutrients, Solanum tuberosum, Drymatter, Sugars.*

INTRODUCTION

Potato is a very popular vegetable grown all over the world and is an important food crop grown in more than 150 countries in the world. Potato *(Solanum tuberosum* L.) is an important food crop after wheat, maize and rice, contributing to food and nutritional security in the world. It is also called as poor man's strength or king of vegetables.

Potato developed as a temperate crop and was later distributed throughout the world. It was introduced to India by early 17th century probably through British missionaries or Portuguese traders.

Cite this article: Manjunath, R.P., Vishnuvardhana, Anjanappa, M., Ramegowda, G. K., Anilkumar, S. and Prasad, P.S., Influence of Foliar Spray of Micronutrient Formulation on Quality and Shelf Life of Potato (*Solanum tuberosum* L.), *Int. J. Pure App. Biosci.* **6(1):** 660-665 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5217

India is now producing 43.77 million tonnes of potato tubers in an area about 2.13 million hectare[2].

Indian agricultural production heavily depends on fertilizer application which results in greater rate of nutrient collapse and soil health problems. Regular depletion of nutrient resources from soils hasled to emergence of several nutrient deficiencies. Most of the Indian soils are widely deficient in micronutrients especially Zn, Mn, B and Fe. The efficiency of applied inorganic micronutrients is rather low due to their fixation in the soil.

However, soil mineral reserves and soil fertilization are not always sufficient to satisfy the needs of crops. Nutritional disorders in potato occur in acidic and alkaline soils. In acidic soils, there is a lack of calcium, magnesium and phosphorus for growing crop and in alkaline soil there is lack of boron, manganese and zinc. The alternative approach is the application of these nutrients to plant leaves and stems through foliar fertilization.

Micronutrients play a very important role in vital processes of plants. They increase the chlorophyll content of leaves, improve photosynthesis which intensify the assimilating activity of the whole plants[9]. Spray of micro-element solution (B, Cu, Mn, Zn and Mo) on potato leaves increased the uptake of N, P, K; chlorophyll content and photosynthesis in leaves, promoted the tuber expansion and increase potato yield[10]. Micronutrients like zinc and manganese also influences the protein and sugar content in potato tubers.

The present study was conducted to investigate the influence of foliar supplementation of micronutrients on quality and shelf life of the potato.

MATERIAL AND METHODS

The soil of the experimental area was sandy loam having good physical and chemical properties and $_{p}$H of the soil was 6.2. This experiment was undertaken to find out the best micronutrient formulation to obtain good growth, yield and yield attributes in potato. The design followed was RCBD (Randomized Complete Block Design) with 12 treatments replicated thrice in aplots of 4.2 x 4 m size with 60 x 20 cm spacing during Kharif 2016. The treatments included under the study were,T_1 (control)- RDF (FYM 25 t/ha + N:P:K at 75:75:100 kg/ha), T_2 - RDF+ Foliar spray of boron at 50 ppm, T_3 -RDF+ Foliar spray of zinc 150 ppm, T_4 -RDF + Foliar spray of zinc 150 ppm + boron 50 ppm, T_5- RDF + Foliar spray of IIHR vegetable special (5g/l), T_6 - RDF + Foliar spray of IIHR potato specific nutrient formulation (4g/l), T_7 -RDF + Foliar spray of UHSB 1 potato micronutrient formulation (3g/l), T_8-RDF + Foliar spray of UHSB 2 potato micronutrient formulation (3g/l), T_9- RDF + Foliar spray of UHSB 3 potato micronutrient formulation (3g/l), T_{10} - RDF + Foliar spray of UHSB 4 potato micronutrient formulation (3 g/l), T_{11} - RDF + Foliar spray of UHSB 5 potato micronutrient formulation (3 g/l) and T_{12}- Only recommended dose of N:P:K without FYM.

Water soluble micronutrients were mixed by using pulverizer and composition of nutrient formulation are presented in Table 2 and were applied at 30, 45 and 60 days after sprouting of tubers. TSS of tubers was estimated by digital hand refractrometer. Sugar estimation was done by Eynon and Lane method explained by Ranganna[13]. Tubers were stored under ambient condition up to 75 days weight loss and potato tuber moth (PTM) infestation during storage at regular intervals were recorded.

RESULTS AND DICUSSION

Quality parameters

There was no significant difference in the TSS content and tuber uniformity of tubers with the foliar application of micronutrients. Significantly highest dry matter (19.76%) was recorded in T_9 (RDF+FYM+UHSB-3) compared to control (16.86%) and was on par with T_8 (19.44%). Similar results were also reported by Ahmad *et al.*[1], Bari *et al.*[3], Mouasavi *et al.*[11], Vinod Kumar *et al.*[14], Dissoky and Khader[5]. The enhanced dry matter production may be attributed to greater

accumulation of photosynthates by vegetative parts. Zinc helps in synthesis of food material and their translocation to developing tubers and thereby increasing size of tubers[14].

Application of micronutrients through IIHR Vegetable Special along with FYM and RDF recorded significantly highest reducing sugar (0.40%) and was on par with T_9, T_{10}, T_8 and T_2. Total sugar in potato tubers measured by Lane and Eynon method differed significantly due to foliar application of micronutrient mixture during crop growth period. Four treatments *viz*., T_9, T_8, $T_{10,}$ and T_5 recorded significantly highest total sugar (0.43%) compared to that of 0.41 per cent in T_{12}, T_1 (control) and T_2.%). This results are in accordance with Gopal *et al*.[6], Chandra and Singh[4] and Parmer *et al*.[12]. Zn and Mn have main role in synthesis of proteins, enzyme activation, oxidation, revival reactions and metabolism of carbohydrates and increased total sugar, reducing sugar and non reducing sugar[12].

Keeping quality at room temperature

Significantly delayed rotting was recorded in T_7 (33 days) which was on par with all other treatments except control. Further per cent total rotten tuber number was recorded lowest (26.98%) in T_{11} (RDF + FYM + UHSB-5) and was on par with T_9 (31.62%) and T_7 (36.11%) and highest (63.69%) for T_{12} (RDF without FYM) compared to control (55.56%). However, Significantly lowest weight loss (46.25%) was recorded in T_{11}(RDF + FYM + UHSB-5) which was followed by T_9 (46.92%).This results are in conformity with Iqbal[7] where combination of Fe, Zn and Mn may reduce weight loss by developing flesh with more combined water which restricts water loss during the early storage periods.

PTM infection and build up during storage

There was a significant difference in the PTM infestation in tubers during storage under ambient condition due to foliar application of micronutrient mixture.

After 30 days of storage lowest tuber infestation (28.40%) was recorded in T_{11} (RDF + FYM + UHSB-5) which was on par with T_4 (32.78%) compared to control (51.10%). At 45 days after storage T_{11} registered lowest PTM infested tubers (33.65%) which was on par with T_{10} (44.75%) T_8 (47.09%), T_9 (47.22%), compared to control (68.89%). In the later stages of storage at 60 and 75 days after storage cent percent tubers were infested in all treatments.

Average number of tunnels per tuber was found non-significant at 30, 45, and 60 days of storage and was ranged between 0.40 to 0.73; 0.93 to 1.20; 0.87 to 1.13 at 30, 45 and 60 days after storage. At 75 days after storage average number of tunnels per tuber was significantly lowest (1.33) in T_8 (RDF + FYM + UHSB-2) and T_6 (Potato special). The maximum number of tunnels per tuber was 2.07 in T_{12} (RDF without FYM).Application of micronutrients which aid in formation of sugars, enzyme, alkaloids, amino acids and phenols which shows resistance to insect pest[8].

Table 1: composition of nutrient formulation

Nutrient formulation	Composition
IIHR Vegetable Special	Zinc (225 ppm), Boron (50ppm), Manganese (42.5 ppm), Iron (105 ppm), Copper (5 ppm)
UHSB-1 formulation	Zinc (50 ppm), Boron (50 ppm), Copper (20 ppm)
UHSB-2 formulation	Zinc (200 ppm), Manganese (100 ppm), Boron (50 ppm), Iron (75 ppm), Copper (20 ppm)
UHSB-3 formulation	Zinc (200 ppm), Manganese (75 ppm), Iron (100 ppm), Boron (75 ppm), Copper (25ppm)
UHSB-4 formulation	Zinc (150 ppm), Manganese (150 ppm), Iron (100 ppm), Boron (75 ppm), Copper (10 ppm)
UHSB-5 formulation	Zinc (50 ppm), manganese (150 ppm), Iron (75 ppm), Boron (75 pm), Copper (25 ppm)

Table 2: Influence of foliar spray of micronutrients dry matter, TSS, reducing sugar, non reducing sugar and total sugar in potato

Treatment	Dry matter content of tuber (%)	TSS (^{0}Brix)	Reducing sugar (%)**	Non reducing sugar (%)**	Total sugar (%)**
T_1: FYM (25 t/ha) + Recommended dose of N:P:K (75:75:100 Kg/ha).	16.86 (48.23)	4.33	0.38 (3.54)	0.03 (0.93)	0.41 (3.67)
T_2: T_1 + Foliar spray of boron at 30, 45 and 60 DAS	17.38 (40.66)	4.47	0.39 (3.57)	0.02 (0.85)	0.41 (3.68)
T_3: T_1 + Foliar spray of zinc at 30, 45 and 60 DAS	18.40 (46.49)	4.57	0.38 (3.54)	0.04 (1.09)	0.42 (3.71)
T_4: T_1 + Foliar spray of zinc + boron at 30, 45 and 60 DAS	18.34 (41.11)	4.57	0.38 (3.51)	0.05 (1.10)	0.42 (3.73)
T_5: T_1 + Foliar spray of IIHR vegetable special at 30, 45 and 60 DAS.	19.35 (44.48)	4.59	0.40 (3.61)	0.03 (0.98)	0.43 (3.75)
T_6: T_1 + Foliar spray of IIHR potato specific nutrient formulation at 30, 45 and 60 DAS.	18.75 (43.79)	4.47	0.37 (3.51)	0.04 (1.12)	0.42 (3.69)
T_7: T_1 + Foliar spray of UHSB 1 potato micronutrient formulation at 30, 45 and 60 DAS	18.20 (36.42)	4.37	0.38 (3.51)	0.04 (1.16)	0.42 (3.71)
T_8: T_1 + Foliar spray of UHSB 2 potato micronutrient formulation at 30, 45 and 60 DAS	19.44 (44.46)	4.68	0.40 (3.61)	0.03 (1.02)	0.43 (3.75)
T_9: T_1 + Foliar spray of UHSB 3 potato micronutrient formulation at 30, 45 and 60 DAS	19.76 (34.09)	4.44	0.39 (3.59)	0.04 (1.26)	0.43 (3.75)
T_{10}: T_1 + Foliar spray of UHSB 4 potato micronutrient formulation at 30, 45 and 60 DAS	18.02 (39.01)	4.87	0.39 (3.56)	0.05 (1.23)	0.43 (3.77)
T_{11}: T_1 + Foliar spray of UHSB 5 potato micronutrient formulation at 30, 45 and 60 DAS	18.85 30.82)	4.57	0.37 (3.50)	0.05 (1.25)	0.42 (3.73)
T_{12}: Recommended dose of N:P:K without FYM	16.33 (52.99)	4.20	0.38 (3.55)	0.03 (0.95)	0.41 (3.68)
S Em±	0.13	0.13	0.02	0.09	0.02
CD 5%	0.39	NS	0.05	0.25	0.06

**arc sin values

DAS – Days after Sprouting

Table 3: Influence of foliar spray of micronutrients on keeping quality and weight loss after 75 days of storage

Treatments	Days taken to tuber rotting (days)	Total rotten tubers @ 75 days of storage (%)**	Weight loss @ 75 days of storage (%)**
T_1: FYM (25 t/ha) + Recommended dose of N:P:K(75:75:100 Kg/ha).	23.67	55.56 (48.23)	63.62 (52.88)
T_2: T_1 + Foliar spray of boron at 30, 45 and 60 DAS	24.33	42.50 (40.66)	56.92 (48.96)
T_3: T_1 + Foliar spray of zinc at 30, 45 and 60 DAS	27.67	52.63 (46.49)	61.08 (51.38)
T_4: T_1 + Foliar spray of zinc + boron at 30, 45 and 60 DAS	31.00	43.33 (41.11)	51.42 (45.79)
T_5: T_1 + Foliar spray of IIHR vegetable special at 30, 45 and 60 DAS.	32.00	49.12 (44.48)	57.42 (49.25)
T_6: T_1 + Foliar spray of IIHR potato specific nutrient formulation at 30, 45 and 60 DAS.	32.67	47.92 (43.79)	49.92 (44.93)
T_7: T_1 + Foliar spray of UHSB 1 potato micronutrient formulation at 30, 45 and 60 DAS	33.00	36.11 (36.42)	53.17 (46.80)
T_8: T_1 + Foliar spray of UHSB 2 potato micronutrient formulation at 30, 45 and 60 DAS	30.67	49.15 (44.46)	56.25 (48.59)
T_9: T_1 + Foliar spray of UHSB 3 potato micronutrient formulation at 30, 45 and 60 DAS	32.67	31.62 (34.09)	46.92 (43.21)
T_{10}: T_1 + Foliar spray of UHSB 4 potato micronutrient formulation at 30, 45 and 60 DAS	32.33	39.81 (39.01)	54.58 (47.62)
T_{11}: T_1 + Foliar spray of UHSB 5 potato micronutrient formulation at 30, 45 and 60 DAS	31.67	26.98 (30.82)	46.25 (42.83)
T_{12}: Recommended dose of N:P:K without FYM	20.67	63.69 (52.99)	63.92 (53.08)
S Em±	2.32	3.75	1.15
CD 5%	6.81	11	3.38

Table 4: Influence of foliar spray of micronutrients on incidence and buildup of PTM during storage of tuber

Treatment	Infested tuber (%)**	Mean No. of tunnels/tuber*	Infested tuber (%)**	Mean No. of tunnels/tuber*	Mean No. of tunnels/tuber*	Mean No. of tunnels/tuber*
	30 DAS		45 DAS		60 DAS	75 DAS
T_1: FYM (25 t/ha) + Recommended dose of N:P:K(75:75:100 Kg/ha).	51.10 (45.62)	0.60 (1.27)	68.89 (56.17)	1.13 (1.56)	1.00 (1.50)	1.87 (1.87)
T_2: T_1 + Foliar spray of boron at 30, 45 and 60 DAS	46.09 (42.73)	0.60 (1.27)	65.76 (54.32)	1.07 (1.53)	1.07 (1.53)	1.87 (1.86)
T_3: T_1 + Foliar spray of zinc at 30, 45 and 60 DAS	37.52 (37.73)	0.53 (1.23)	55.97 (48.46)	1.07 (1.53)	0.87 (1.43)	1.87 (1.86)
T_4: T_1 + Foliar spray of zinc + boron at 30, 45 and 60 DAS	32.78 (34.82)	0.60 (1.27)	53.33 (47.10)	0.87 (1.43)	0.87 (1.42)	1.60 (1.76)
T_5: T_1 + Foliar spray of IIHR vegetable special at 30, 45 and 60 DAS.	43.57 (41.28)	0.40 (1.12)	56.43 (48.88)	0.87 (1.43)	0.87 (1.42)	1.53 (1.74)
T_6: T_1 + Foliar spray ofIIHR potato specific nutrient formulation at 30, 45 and 60 DAS.	37.90 (37.96)	0.53 (1.22)	69.64 (61.79)	0.93 (1.46)	0.93 (1.46)	1.33 (1.65)
T_7: T_1 + Foliar spray ofUHSB 1 potato micronutrient formulation at 30, 45 and 60 DAS	47.22 (43.38)	0.60 (1.27)	53.33 (46.90)	0.93 (1.46)	1.07 (1.53)	1.67 (1.79)
T_8: T_1 + Foliar spray ofUHSB 2 potato micronutrient formulation at 30, 45 and 60 DAS	53.31 (46.89)	0.47 (1.16)	47.09 (43.28)	0.93 (1.46)	0.93 (1.46)	1.33 (1.65)
T_9: T_1 + Foliar spray of UHSB 3 potato micronutrient formulation at 30, 45 and 60 DAS	39.32 (38.78)	0.47 (1.16)	47.22 (43.38)	1.07 (1.53)	0.87 (1.42)	1.53 (1.74)
T_{10}: T_1 + Foliar spray ofUHSB 4 potato micronutrient formulation at 30, 45 and 60 DAS	42.79 (40.83)	0.67 (1.31)	44.75 (41.95)	1.20 (1.59)	0.87 (1.43)	1.60 (1.76)
T_{11}: T_1 + Foliar spray ofUHSB 5 potato micronutrient formulation at 30, 45 and 60 DAS	28.40 (32.17)	0.73 (1.35)	33.65 (35.43)	1.00 (1.50)	1.07 (1.53)	1.67 (1.79)
T_{12}: Recommended dose of N:P:K without FYM	61.31 (51.53)	0.73 (1.35)	79.76 (64.03)	1.20 (1.59)	1.13 (1.56)	2.07 (1.94)
S Em±	1.59	0.07	5.48	0.05	0.05	0.03
CD 5%	4.66	NS	16.07	NS	NS	0.10

* √x +0.5 values **arc sin values

DAS – Days after Sprouting

CONCLUSION

By this experiment we can conclude that foliar application of micronutrient formulation along with soil application of RDF (75:75:100 kg/ha of N:P:K) and FYM (25 t/ha) was found more economical in terms of quality parameters like dry matter, physiological weight loss, total sugar, reducing sugar and shelf life of tubers.

REFERENCES

1. Ahmad, N., Avais, M.A., Saqib, M., Bhatti K.M. and Anwar, S.A. Response of potato (*Solanum tuberosum)* to seed and foliar application of iron and manganese. *Pak. J. Agri. Sci.*, **37:** 3-4 (2000).
2. Annonymous. 3rd advanced estimates for 2015-16. National Horticulture Board, Gurgaon, pp. 1 (2016).
3. Bari, M.S., Rabbani, M.G., Rahman, M.S., Islam, M.J. and Hoque, M.R. Effect of zinc, boron, sulphar and magnesium on growth and yield of potato. *Pak. J. Biol. Sci.*, **4(9):** 1090-1093 (2001).
4. Chandra, R. and Singh, K. K. Foliar application of zinc sulphate, magnesium sulphate and copper sulphate on yield and quality of aonla (*Emblica officinallis* Gaerth L.) cv. NA-47 under Garhwal Himalaya. *J. Medicinal Pl. Studies*, **3(5):** 42-45 (2015).

5. Dissoky, R.A.E. and Kadar, A.E.S. Effect of boron as a foliar application on some potatoes cultivars under Egyptian alluvial soil conditions. *Res. J. Agric. Biol. Sci.*, **9(5):** 232-240 (2013).
6. Gopal, R., Dube, B.K. and Chatterjee, C. Effect of manganese stress on yield, productivity and metabolism of potato. *Indian J. Hort.*, **63(2):** 174-177 (2006).
7. Iqbal, J.M. Response of potato crop to zinc sulfate application. Proceeding of National Seminar Held at NARC, Islamabad (1995).
8. Khan, M.A., Abbas, M.W., Gogi, M.D., Ali, M.A. and Raza, M.F. Impact of micro and macro-nutrient foliar fertilizer use on the population of wheat aphid, *Diuraphisnoxia* (Hemiptera: Aphididae) and wheat yield. *Academic J. Ent*., **8(1):** 5-11 (2015).
9. Marschner, H. Mineral nutrition of higher plants. 2nd Ed. Academic Press, London. pp. 889 (1995).
10. Meng, M.L., Yic, M.F., Jun, Y. and Lin, Y.Z. Research Progress on cultivation Physiology of potato in China 5th world Potato Congress, August, pp. 16 (2004).
11. Mousavi, S.R., Galavi, M. and Ahmadavand, G. Effect of zinc and manganese foliar application on yield quality and enrichment on potato (*Solanum tuberosum* L.). *Asian J. Pl. Sci.*, **6(8):** 1256-1260 (2007).
12. Parmar, M. Nandre, B.M. and Pawar, Y. Influence of foliar supplementation of zinc and manganese on yield and quality of potato, *Solanum tuberosum* L. *Int. J. Farm Sci*., **6(1) :** 69-73 (2016).
13. Ranganna, S. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Publishing Co. Ltd., New Delhi. pp. 190-210 (1986).
14. Vinod, K., Vyakarnahal, B.S., Basavaraj, N., Srikant, K. and Gouda, S.M. Influence of micronutrients on growth and yield of potato (*Solanum tuberosum*) cultivars. *Ind. J. Agric. Sci.*, **78(9):** 752-6 (2008).