International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 9, Issue 32, 2017, pp.-4476-4478.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

EFFECT OF ZINC AND IRON ON QUALITY OF AMARANTH (*AMARANTHUS SPP*) *CV* PUSA KIRAN

JAT GIRRAJ PRASAD *, VADODARIA J.R., KARTHICK K. AND VARSAT BHAVIK A.

Department of Vegetable Science, College of Horticulture, Jagudan, 382 710 , Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, India
*Corresponding Author: Email-girirajrca@gmail.com

Received: June 15, 2017; Revised: June 24, 2017; Accepted: June 25, 2017; Published: July 12, 2017

Abstract- The quality parameters are concerned chlorophyll a, chlorophyll b, total chlorophyll, and protein content were significantly increased by individual application of zinc @ 0.45 % and iron @ 0.30 % concentration. While carotenoid content was recorded highest in the plants which did not received any treatment. Combined application of zinc and iron @ 0.45 % increased almost all quality parameters though carotenoid content was maximum in treatment without application of any treatment.

Keywords- Zinc, Iron, Amaranth.

Citation: Jat Girraj Prasad, et al., (2017) Effect of Zinc and Iron on Quality of Amaranth (*Amaranthus spp.*) *cv*. Pusa Kiran. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 9, Issue 32, pp.-4476-4478.

Academic Editor / Reviewer: Attri B. L.

Introduction

Amaranth (*Amaranthus spp*.) popularly known as *chaulai,* is very nutritive and highly suitable crop for kitchen gardening and commercial cultivation. Rapid growths, quick rejuvenation after each cutting and high yield of edible matter per unit area in minimum time as well as high nutritive value are its important features. It is one of the cheapest leafy vegetables in tropical and subtropical parts of the country. It could be a very valuable source for combating under-nutrition and malnutrition. It fits well in crop rotations because of its short-duration and large yield per unit area. Amaranth is unique in many respects: it is easy to cultivate in kitchen garden or on large scale and respond very favorably to fertilizers and organic matter.

Generally, zinc is accumulated in the plant, which range from 25 to 50 ppm. If the range is going below 20 ppm consider as deficiency and it goes above 400ppm consider as toxicity. Capacity of zinc absorption form soil is varying from genotypes to genotypes. It may due to the ability of genotypes to consume and use zinc irons [1]. Iron is a needed element to the plants for full fill the chlorophyll formation and photosynthesis process. Almost all plant enzymes are using iron ions to make the proper transpiration cycle in plants. Iron deficiency will discard the high yield and quality of plants. This experiment was conducted to know the proper required concentration of iron for harvesting good quality of amaranth leaves.

Materials and Methods

This study was conducted during *summer*-2016 at Horticulture Instructional Farm, Department of Horticulture, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat). This experiment was laid out in randomized block design with factorial concept for two factors *viz*. zinc and iron. In this field study each factor with four levels (0%, 0.15%, 0.30% and 0.45%) and three replications were used. Thus, there were total sixteen treatments under study. In this present experiment zinc and iron were applied as foliar application 7 DAS. The crop was sown at a row distance of 30 cm and 10 cm plant to plant within row with a seed rate 2 kg/ha.

A uniform application of recommended dose of NPK (100, 50, 20 kg/ha) through urea, SSP and MOP respectively were applied. The nutrients, 50 % dose of N and 100 % dose of P and K were applied as basal dose. Remaining 50% dose of N was applied in two equal splits as top dressing after second and third cutting. Data for quality parameters *viz*. chlorophyll a, b, total hlorophyll, carotenoid content (mg/g leaves), crude protein content (%) and Iron content (mg/100g) were recorded from entire net plot, which was subjected to statistical analyses. Laboratory work was carried out at Castor and Mustard Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Chlorophyll a, b and totalchlorophyll as well as carotenoid content of leaves was measured as per method suggested by Sadasivam and Manickam [2].

The treatment wise total nitrogen percentage (in green leaves) was estimated by using micro- Kjeldahl's method [3]. The nitrogen percentage was multiplied by factor 6.25 to obtain crude protein content. For iron content sample was wet ashed using H_2SO_4, HNO_3 and $HClO_4$. An aliquot of the extract is treated with thioglycollic acid and the colour is read in photometer at 535m.

Result and discussion

Data related to quality parameters of amaranth is presented in [Table-1].

Effect of zinc on quality parameters

Inspection of data showed significant difference for different quality parameters *viz*. chlorophyll a, chlorophyll b, total chlorophyll, carotenoid (mg/g leaves), crude protein (%) and Iron (mg/100g) content among different levels of Zinc. Significantly maximum chlorophyll a (1.29 mg/g leaves), chlorophyll b, (0.71 mg/g leaves), total chlorophyll (2.00 mg/g leaves), crude protein (3.34 %) and iron (12.66 mg/100g) contentwas recorded with application of zinc @ 0.45 %. Whereas maximum carotenoid content (0.25 mg/g leaves) was recorded with zinc @ 0 %. While minimum Chlorophyll b (0.53 mg/g leaves), total chlorophyll (1.70 mg/g leaves), crude protein (3.10 %)and iron (12.36 mg/100g) was recorded with application of zinc @ 0 % zinc. Whereas lowest chlorophyll a (1.16 mg/g leaves) and carotenoid (0.19 mg/g leaves) content was recorded with application of zinc @ 0.30 % and with application of zinc @ 0.45% respectively.

Significant variation among the different levels of zinc and iron and their

interaction for chlorophyll a, chlorophyll b and total chlorophyll content might be due to involvement of zinc and iron in chlorophyll formation. The similar findings are accordance with [4] in Chinese cabbage and [5] in lettuce. Zinc acts as metal components of various enzymes, as a functional, structural or regulatory cofactor for protein synthesis. It might be reason for increasing protein content in treatments receiving higher dose of zinc. Iron is associated with nitrogen content and it is also used by enzymes which are positively correlated with protein content. This might be reason for high protein content in treatments receiving higher dose of zinc and iron. The similar findings are accordance with [6] in potato.

Table-1 *Effect of zinc and iron on different quality parameters of amaranth*

Treatments	Chlorophyll a (mg/g leaves)	Chlorophyll b(mg/g leaves)	Total Chlorophyll(mg/g leaves)	Carotenoid (mg/g leaves)	Crude protein (%)	Iron (mg/100g)
Level of Zinc (z)						
0.00 % Zinc	1.17	0.53	1.70	0.25	3.10	12.36
0.15 % Zinc	1.22	0.65	1.87	0.21	3.23	12.54
0.30 % Zinc	1.16	0.67	1.83	0.20	3.24	12.37
0.45 % Zinc	1.29	0.71	2.00	0.19	3.34	12.66
S.Em.±	0.02	0.005	0.02	0.002	0.03	0.09
C.D. at 5%	0.05	0.01	0.05	0.01	0.08	NS
Level of Iron (i)						
0 % Iron	1.01	0.50	1.52	0.27	3.09	11.04
0.15 % Iron	1.20	0.62	1.82	0.21	3.21	12.50
0.30 % Iron	1.32	0.66	1.98	0.20	3.23	12.66
0.45 % Iron	1.31	0.77	2.08	0.15	3.39	13.72
S.Em.±	0.02	0.005	0.02	0.002	0.03	0.09
C.D. at 5%	0.05	0.01	0.05	0.01	0.08	0.27
Interaction (zxi)						
z_0i_0	0.88	0.35	1.23	0.33	2.80	11.11
z_0i_1	1.14	0.50	1.64	0.26	3.07	12.69
z_0i_2	1.28	0.55	1.83	0.24	3.28	12.32
z_0i_3	1.35	0.74	2.10	0.16	3.24	13.34
z_1i_0	1.07	0.56	1.63	0.24	3.18	11.02
z_1i_1	1.23	0.62	1.85	0.21	3.28	12.48
z_1i_2	1.34	0.63	1.97	0.22	3.22	13.00
z_1i_3	1.25	0.78	2.03	0.15	3.23	13.65
z_2i_0	1.06	0.55	1.61	0.25	3.21	11.06
z_2i_1	1.08	0.65	1.73	0.20	3.29	12.29
z_2i_2	1.32	0.74	2.06	0.17	3.20	12.38
z_2i_3	1.18	0.74	1.91	0.18	3.27	13.75
z_3i_0	1.05	0.55	1.60	0.25	3.17	10.98
z_3i_1	1.34	0.72	2.06	0.18	3.18	12.52
z_3i_2	1.34	0.72	2.06	0.18	3.21	12.96
z_3i_3	1.34	0.83	2.28	0.13	3.80	13.72
S.Em.±	0.04	0.009	0.04	0.002	0.05	0.19
C.D. at 5%	0.1	0.03	0.14	0.01	0.15	NS
CV%	5.02	3.44	3.44	3.76	2.87	2.59

Effect of iron on quality parameters

Inspection of data showed significant difference for different quality parameters *viz*. chlorophyll a, chlorophyll b, total chlorophyll, carotenoid (mg/g leaves), crude protein (%) and Iron (mg/100g) content among different levels of iron. Significantly maximum chlorophyll a (1.32 mg/g leaves) was recorded with application of iron @ 0.30 % which was at par with 0.45 % iron. While maximum chlorophyll b (0.77 mg/g leaves),total chlorophyll (2.08 mg/g leaves), crude protein (3.39 %) andiron (13.72 mg/100g) content was recorded with application of iron @ 0.45 %,whereas maximum carotenoid (0.27 mg/g leaves) was recorded with application of iron @ 0 %.Whereas minimum chlorophyll a(1.01 mg/g leaves),chlorophyll b (0.50 mg/g leaves) total chlorophyll(1.52 mg/g leaves), protein (3.09 %) and iron content (11.04 mg/100g) was recorded without application of iron. While minimum carotenoid content (0.15 mg/g leaves) was recorded with application of iron @ 0.45 %. Increase in iron content with increasing levels of iron application might be attributed due to increasing accumulation of iron by leaves of amaranth and uptake of more iron by plants receiving higher dose of iron. These results are supported by [7] in amaranth. Reduction of carotenoid content as levels of zinc and iron increases, might be due to negative correlation between chlorophyll content and carotenoid content. The similar findings are accordance with [4] in Chinese cabbage and [8] in lettuce.

Effect of interaction of iron and zinc on quality parameters

Reported data showed that interaction of different levels of iron and zinc for chlorophyll a, chlorophyll b, total chlorophyll, carotenoid (mg/g leaves) and crude protein (%) contentwas found significant .Maximum chlorophyll a (1.45 mg/g leaves), chlorophyll b (0.83 mg/g leaves), total chlorophyll(2.28 mg/g leaves) and protein (3.80 %) content was found with application of zinc and iron @ 0.45 %. While maximum carotenoid content (0.33 mg/g leaves) was found with no application of zinc and iron. Minimum chlorophyll a content (0.88 mg/g leaves), chlorophyll b content (0.35 mg/g leaves) total chlorophyll content (1.23 mg/g leaves) protein content (2.80 %)was observed with treatment T_1. While minimum carotenoid content (0.13 mg/g leaves) was observed with application of zinc and iron @ 0.45 %. Interaction of different levels of iron and zinc was found not significant with respect to iron content. Significant variation among the different levels of zinc and iron and their interaction for chlorophyll a, chlorophyll b and total chlorophyll content might be due to involvement of zinc and iron in chlorophyll formation. The similar findings are accordance with [4] in Chinese cabbage and [5] in lettuce.

Conclusion

Among different levels of zinc and iron, application of zinc and iron @ 0.45 % was found superior for quality of amaranth. Hence, on the basis of this it could be concluded that foliar application of zinc and @ 0.45 % at 7 days after sowing should be applied to obtain good quality amaranth vegetable.

Abbreviations

DAS – Days after sowing
Viz.– Namely
@ - at the rate of
ppm – Parts per million

% - percent
N – Nitrogen
P – Phosphorous
K – Potash
SSP – Single super phosphate
MOP – Muriate of potash

Author contributions

Girraj Prasad Jat*- Acquisition of data, analysis and interpretation of data, drafting of Manuscript.
J.R. Vadodaria- Investigator of the research work and guidelines for research work
Karthick K- Study design and conception and helped for acquisition of data.
Bhavik A. Varsat- helped for statistical analyzing and typing of thesis.

Acknowledgement

The authors are highly thankful to the College of Horticulture, S.D. Agricultural University, Jagudan for providing necessary facilities support to carry out this research work.

Conflict of Interest: None declared

References

[1] Tisdale S. L., Nelson W. L. and Beaton J. L. (1993) Soil Fertility and Fertilizers. 5th ed. New Jersey, USA: Pearson Education.
[2] Sadasivam S. and Manickam A. (1996). Biochemical Methods. New Age International Publishers, New Delhi.
[3] AOAC (1995) Official methods of analysis. 16th edn. *Association of Official Analytical Chemists*, Washington, DC.
[4] XinMin Du and Yong Qing Zhang (2008) *Acta Botanica Boreali-Occidentalia,* 28(6) 1203-1207.
[5] Tavakoli M. M., Bagheri V. and Roosta H. R. (2015) *Journal of Science and Technology of Greenhouse Culture,* 5(20), 41-49.
[6] Kozera W.K. Nowak and Cwojdzinski W. (2003) *Acta Scientiarum Polonorum Agricultura*, 2(2): 73-82.
[7] Patel K. I., Patel B. M., Patel S. J., Patel P. T., Patel S. M. and Patel P. M. (2012) *Agric. Sci. Digest*, 32(3), 193–198.
[8] Roosta H. R., Jalali M., Shahrbabaki and S. M. A. V. (2015) *Plant Nutrition*, 38(14), 2176-2184.