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Response of Micronutrients to Seed Quality in *Coriandrum sativum* L.

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***Abstract*:** The present investigation was carried out at CCS Haryana Agricultural University, Hisar, Haryana during 2017-18 and 2018-19 to access the effect of micronutrients on seed quality in coriander. The experiment consisted of soil and foliar application of micronutrients i.e., recommended dose of fertilizers as control, and recommended dose of fertilizers was used in combination with ferrous sulphate (5, 7.5 and 10 Kg/ha), zinc sulphate (3, 4 and 5 Kg/ha), boric acid (2, 3 and 4 Kg/ha), water spray as soli application. The foliar application of ferrous sulphate (0.4, 0.5 and 0.6 %), zinc sulphate (0.4, 0.5 and 0.6 %) and boric acid (0.2, 0.3 and 0.4 were done at 45 and 90 DAS. The soil application of micronutrients with 5 kg zinc sulphate/ha with recommended dose of fertilizers recorded significantly maximum standard germination (92%), seedling length (24.86 cm), seedling dry weight (3.45 mg), vigour index – I & II (2286.56 & 317.37), catalase (0.490 mg protein^{-1} min^{-1}), peroxidase (0.547 mg protein^{-1} min^{-1}), dehydrogenase (0.075 OD g^{-1} ml^{-1}), superoxidase dismutase (0.925 mg protein^{-1} min^{-1}), speed of germination (7.54), seedling establishment percentage (85.75%) and mean emergence time in days (11.37).

***Keywords*:** Coriander, Micronutrients, Enzyme activity, Germination, Seed quality

Coriander (*Coriandrum sativum* L.), belongs to the family Apiaceae and possessing chromosome number 22 with cross pollination mode of reproduction, is an important and remunerative spice crop. It is native to Mediterranean region and is grown throughout the country in *Rabi* season. India is the largest producer of coriander with a production share of more than 70 per cent of the total world production. The total area under coriander crop is 583000 hectares with annual production of 784000 MT (NHB 2018-19). In Haryana, the crop is grown during *Rabi* season occupying an area of 2.41 thousand hectares with the production of 4.4 thousand MT during 2016-17 (Anonymous 2017). Seed is an important component of agricultural production. The quality seed plays important role in the agricultural production as well as in national economy. Among the seed spices, coriander is very susceptible to loss in quality in terms of seed viability and vigour during seed storage. Retention of seed viability during storage has always been of utmost concern to seed merchants and farmers. The role of micronutrients in photosynthesis, N-fixation, respiration and other metabolic processes of the plant is well documented (Naga et al 2013). Micronutrients such as iron, zinc, manganese, copper and boron are the important elements with specific and essential physiological functions in plants. They are required in small quantity for normal growth and development of plants. Zinc is an essential component of a number of enzymes, i.e., dehydrogenase, aldolase, isomerases, proteinase, peptidase and phosphohydrolase (Mousavi 2011). It is directly involved in the synthesis of indole acetic acid (IAA) and proteins. Boron helps in the absorption of water and carbohydrates metabolism (Haque et al 2011), translocation of carbohydrates in plants, DNA synthesis in meristems, cell division and elongation, active salt absorption, fertilizer, water relation, photosynthesis and involved indirectly in metabolism of nitrogen, phosphorus, fat and hormones. Boron also plays an important role in flowering and fruit formation. Keeping in view the aforesaid facts, the present study entitled "Response of micronutrients to seed quality in *Coriandrum sativum* L" was performed.

MATERIAL AND METHODS

The present investigation was carried out at CCS Haryana Agricultural University, Hisar, Haryana during 2017-18 and 2018-19. Hisar is situated between 29°10' North latitude and 75°46' East longitudes and 215.2 m above mean sea level. This tract is characterized by semi-arid climate. Hot and dry winds during summer and dry severe cold in winter are the common features of the region. The field selected for conducting the experiment was uniform in fertility gradient. The soil of the experimental field was sandy loam in texture, non-saline, medium in organic carbon, low in available nitrogen and high in available phosphorus and potassium.

A newly developed variety of coriander "Hisar Bhoomit" (DH-228) was used as a planting material with 20 treatments of micronutrient along with recommended dose of FYM 20 tonne, nitrogen 62.5 kg and phosphorus 50 kg per hectare (Table 1).

The seed was sown in the field with recommended practices and treatments were given in the plots. The foliar application of nutrients was done at 45 and 90 DAS. The crop was harvested separately according to different treatments. The seed obtained from various treatment combinations were utilized for assessing the seed vigour potential on the basis of the following parameters.

Observations: One thousand seeds replicated four times in each treatment were counted, weighed and average seed weight of each treatment was calculated. Hundred seeds of each treatment from each replication were placed between the germination papers at a temperature of 25±1ºC and 90-95 per cent relative humidity for estimation of germination (ISTA, 2011). The first count was taken on 7th day and final count on 21st day. The total root and shoot length of five randomly selected seedlings from each treatment in each replication was measured in cm at the time of termination of germination test and averaged. Seedling dry weight was assessed after the final count in the standard germination test (21 days). The five seedlings of each treatment replicated four times were taken. Seedlings were dried in a hot air oven for 48 h at 80±1°C. The dried seedlings of each replication were weighed and average seedling dry weight of each treatment was calculated. Seedling vigour indices (I & II) were calculated according to the method suggested by Abdul-Baki and Anderson (1973). For accelerated ageing sufficient number of seeds in a single layer from each treatment was taken on wire mesh tray fitted in plastic boxes having 40 ml of distilled water. The boxes were placed in ageing chamber after closing their lids. The seeds were placed at 40±1°C temperature and about 100 per cent relative humidity for 120 h and tested for germination in four replications of 100 seeds for each treatment. Then, the seeds were evaluated in terms of standard germination only. Electrical conductivity ($\mu S\ cm^{-1}\ g^{-1}$) was recorded as per method suggested by ISTA (1999).

The catalase activity was assessed by using the method described by Aebi (1983), which was based on the reduction of potassium dichromate to chromic acetate by hydrogen peroxide. POD activity was determined by the method of Shannon et al (1966) following the oxidation of O-dianisidine in the presence of hydrogen peroxide (H_2O_2). Dehydrogenase activity was measured by method suggested by Kittock and Law (1968) while in case the SOD activity was examined by the method of Giannopolitis and Ries (1977).

Field observations: One hundred seeds in four replications of each treatment combination stored under ambient conditions were sown in a randomized block design during *Rabi* season of 2017-18 and 2018-19 at Department of Seed Science and Technology, CCS Haryana Agricultural University, Hisar. The following observations were recorded in the field.

Speed of germination: The number of seedlings emerged were counted on each day from 1st day to 30th day and the field emergence index (speed of emergence) was calculated as described by Maguire (1962).

Field emergence index = + …… + Mean emergence time (days)

The mean emergence time was calculated for each treatment combination using the formula cited by Ellis and Robert (1980).

Mean Emergence Time = $\sum nt / \sum n$

Where, n = number of seeds newly germinated at time't'

t = days from sowing $\sum n$ = final emergence of seedlings

Seedling establishment (%)

The seedling establishment was determined by counting the total number of seedlings when the emergence was completed or when there was no further addition in the total emergence, i.e., on 30thday.

Statistical analysis: The data obtained from the experiment

Table 1. Detail of different treatment combinations of micronutrients

T_1	: Control		(RDF)	T_{11}	: Water spray		
T_2	: $FeSO_4$	5 kg/ha	(Soil application)	T_{12}	: $FeSO_4$	0.4 %	(Foliar spray)
T_3	: $FeSO_4$	7.5 kg/ha	(Soil application)	T_{13}	: $FeSO_4$	0.5 %	(Foliar spray)
T_4	: $FeSO_4$	10 kg/ha	(Soil application)	T_{14}	: $FeSO_4$	0.6 %	(Foliar spray)
T_5	: $ZnSO_4$	3 kg/ha	(Soil application)	T_{15}	: $ZnSO_4$	0.4 %	(Foliar spray)
T_6	: $ZnSO_4$	4 kg/ha	(Soil application)	T_{16}	: $ZnSO_4$	0.5 %	(Foliar spray)
T_7	: $ZnSO_4$	5 kg/ha	(Soil application)	T_{17}	: $ZnSO_4$	0.6 %	(Foliar spray)
T_8	: H_3BO_3	2 kg/ha	(Soil application)	T_{18}	: H_3BO_3	0.2 %	(Foliar spray)
T_9	: H_3BO_3	3 kg/ha	(Soil application)	T_{19}	: H_3BO_3	0.3 %	(Foliar spray)
T_{10}	: H_3BO_3	4 kg/ha	(Soil application)	T_{20}	: H_3BO_3	0.4 %	(Foliar spray)

was analyzed using the online statistical tool (OPSTAT) developed by Sheoran (2010).

RESULTS AND DISCUSSION

All the treatments showed significant variation for germination percentage (Table 2). Pooled data indicated that maximum germination (92%) was in T7 treatment which was at par with T6, T4, T3, T2 and T5 treatments. Minimum germination (84.63%) was in control. The higher germination percentage also might be due to the bolder seeds that contain greater metabolites for resumption of embryonic growth during germination and better accumulation of food reserves like protein and carbohydrates as reported by Anitha et al (2015) in fenugreek. The results are in accordance with the findings of Lal et al (2015) in fenugreek and Deepika and Anitha (2016) in radish.

A significant variation was observed in seedling length. Higher seedling length (24.86 cm) was with T7 treatment which was at par with T6, T4 and T3 treatments while the lowest seedling length was (21.23cm) observed in control (Table 2). This might be due to release of certain enzymes by metabolites which are responsible for the conversion of macromolecules into micro molecules within the seed and increase in mobilization efficiency led to the increase in seedling length as reported by Santosh (2012) in tomato and Chanchan et al (2013) in garlic. The maximum seedling dry weight (3.45 mg) was in T7 and minimum (2.95 mg) in control. Accumulation of higher quantities of seed constituents like carbohydrates in the seed is due to the participation of micronutrients (Zn, Fe, B) in catalytic activity and breakdown of complex substances into simple form (glucose, amino acids and fatty acids etc.). These in turn reflected on enhancing the germination, elongation of root and shoot in brinjal seedling (Yogannand 2001) and higher seedling length there by increased the seedling dry weight. Similar results were reported earlier in bitter gourd by Arvind Kumar et al (2012).

Higher vigour index-I (2286.56) and vigour index-II (317.37) were in the seeds which was in T7 and was at par with T6 and lower vigour index-I (1796.94) and vigour index-II (249.27) was observed in control. These results are in agreement with the findings of Yogannand (2001) in bell pepper. Coriander seeds lost their germination up to 50% after the accelerated ageing for 120 h at 40±1ºC with 100% relative humidity. The decline in germination during accelerated ageing is related to the degree of deterioration of

Table 2. Effect of micronutrients on test weight, standard germination, seedling length, seedling dry weight of coriander cv. Hisar Bhoomit

Treatments		Test weight (g)	Standard germination (%)	Seedling length (cm)	Seedling dry weight (mg)
T_1	Control (RDF)	8.80	84.63	21.23	2.95
T_2	$FeSO_4$ 5 kg/ha (Soil application)	9.15	90.63	24.29	3.36
T_3	$FeSO_4$ 7.5 kg/ha (Soil application)	9.16	90.88	24.51	3.41
T_4	$FeSO_4$ 10 kg/ha (Soil application)	9.18	90.88	24.67	3.41
T_5	$ZnSO_4$ 3 kg/ha (Soil application)	9.12	90.38	24.19	3.34
T_6	$ZnSO_4$ 4 kg/ha (Soil application)	9.21	91.63	24.77	3.42
T_7	$ZnSO_4$ 5 kg/ha (Soil application)	9.23	92.00	24.86	3.45
T_8	H_3BO_3 2 kg/ha (Soil application)	9.04	89.00	23.69	3.31
T_9	H_3BO_3 3 kg/ha (Soil application)	9.06	89.38	23.97	3.33
T_{10}	H_3BO_3 4 kg/ha (Soil application)	9.09	89.38	24.11	3.33
T_{11}	Water spray	8.81	84.75	21.35	2.98
T_{12}	$FeSO_4$ 0.4 % (Foliar spray)	8.86	86.75	22.57	3.16
T_{13}	$FeSO_4$ 0.5 % (Foliar spray)	8.89	86.88	22.72	3.21
T_{14}	$FeSO_4$ 0.6 % (Foliar spray)	8.92	87.00	22.96	3.22
T_{15}	$ZnSO_4$ 0.4 % (Foliar spray)	8.96	87.25	23.10	3.25
T_{16}	$ZnSO_4$ 0.5 % (Foliar spray)	9.00	87.50	23.25	3.29
T_{17}	$ZnSO_4$ 0.6 % (Foliar spray)	9.02	87.63	23.49	3.29
T_{18}	H_3BO_3 0.2 % (Foliar spray)	8.82	85.25	21.77	3.02
T_{19}	H_3BO_3 0.3 % (Foliar spray)	8.85	85.38	22.32	3.08
T_{20}	H_3BO_3 0.4 % (Foliar spray)	8.85	85.63	22.43	3.13
C.D. (p=0.05)		0.29	1.90	0.46	0.07

the seed. Higher standard germination (53.00%) after accelerated ageing was observed with T7 and was closely related with T6. Similar results were reported earlier by Iqbal et al (2002) in cotton and Rithichai et al (2009) in coriander.

Significant variation in electrical conductivity of seed leachates was observed in response to different micronutrient treatments (Table 3). Lower seed leachates (114.63 µS $cm^{-1}g^{-1}$) were produced by seed produced under T7 whereas maximum (182.05 µS $cm^{-1}g^{-1}$) was observed in control. The soil application of zinc sulphate increased the cell membrane stability and decreased the leakage of solutes from the seeds. Similar results have been reported earlier by Raissi et al (2012) in isabgol.

The present investigation showed differences in enzyme activities among different micronutrient treatments. The activities of all the antioxidant enzymes showed varied differences among all the treatments (Table 4). More activities of catalase (0.490 mg $protein^{-1}$ min^{-1}), peroxidase (0.547 mg $protein^{-1}$ min^{-1}), dehydrogenase (0.075 OD g^{-1} ml^{-1}) and superoxidase dismutase (0.925 mg $protein^{-1}$ min^{-1}) enzymes were observed in treatment T7 whereas less activities of all the above-mentioned enzymes were low in control (0.331 mg $protein^{-1}$ min^{-1}, 0.379 mg $protein^{-1}$ min^{-1}, 0.048 OD g^{-1} ml^{-1} and 0.610 mg $protein^{-1}$ min^{-1} respectively). The increased activities of these enzymes helped in the removal of free radicals like H_2O_2 and O_2 available in normal or abnormal conditions and maintained the ascorbate pool which in turn led to better growth and tolerance in the plant. Similar findings have been reported Abd El- Ghany, (2007) in wheat and Siavoshi et al (2013) in rice.

Results pertaining to speed of germination and seedling establishment (%) revealed significant differences among the different micronutrient treatments (Table 5). Higher speed of germination (7.54), seedling establishment percentage (85.75 %) and significantly lower mean emergence time (11.37 days) was recorded with the treatment T7 which was at par treatments T6, T4 and T3 whereas, minimum was observed in control. Higher speed of germination might be due to bolder seeds that contain greater metabolites for consumption of embryonic growth during germination as reported by Kumar and Uppar (2007) in moth bean. The results are in close conformity with the

Table 3. Effect of micronutrients on vigour index-I & II, germination after accelerated ageing test and electrical conductivity of coriander cv. Hisar Bhoomit

Treatments	Vigour index-I	Vigour index-II	Germination (%) after AA test	Electrical conductivity (µ S cm^{-1} g^{-1})
T_1	1796.94	249.27	34.88	182.05
T_2	2202.03	304.54	48.88	129.46
T_3	2227.81	309.47	49.38	125.89
T_4	2242.66	309.54	50.63	122.61
T_5	2185.49	301.86	47.50	132.71
T_6	2269.90	313.62	51.63	118.34
T_7	2286.56	317.37	53.00	114.63
T_8	2108.60	294.18	44.75	142.57
T_9	2142.68	297.44	46.38	139.37
T_{10}	2155.10	297.61	46.88	135.90
T_{11}	1809.67	252.13	35.50	178.49
T_{12}	1958.42	273.95	39.25	163.04
T_{13}	1974.01	278.51	40.13	159.70
T_{14}	1997.96	280.07	40.50	156.52
T_{15}	2015.42	283.62	41.88	153.07
T_{16}	2034.43	288.20	42.75	149.68
T_{17}	2058.68	288.58	43.63	146.15
T_{18}	1856.45	257.48	36.50	174.98
T_{19}	1905.58	262.57	37.13	171.32
T_{20}	1920.66	268.00	38.63	167.18
C.D. (p=0.05)	63.02	7.66	1.18	2.54

See Table 1 for details

Table 4. Effect of micronutrients on enzymatic activity of coriander cv. Hisar Bhoomit

Treatments	Catalase (mg protein^{-1} min^{-1})	Peroxidase (mg protein^{-1} min^{-1})	Dehydrogenase (OD g^{-1} ml^{-1})	Superoxidase dismustase (mg protein^{-1} min^{-1})
T_1	0.331	0.379	0.048	0.610
T_2	0.464	0.495	0.070	0.795
T_3	0.470	0.510	0.072	0.815
T_4	0.477	0.520	0.073	0.890
T_5	0.454	0.485	0.065	0.780
T_6	0.484	0.525	0.075	0.895
T_7	0.490	0.547	0.075	0.925
T_8	0.427	0.441	0.061	0.745
T_9	0.438	0.455	0.062	0.755
T_{10}	0.444	0.467	0.064	0.765
T_{11}	0.341	0.385	0.048	0.625
T_{12}	0.370	0.395	0.052	0.685
T_{13}	0.379	0.403	0.053	0.670
T_{14}	0.391	0.411	0.054	0.705
T_{15}	0.399	0.419	0.056	0.700
T_{16}	0.407	0.424	0.058	0.715
T_{17}	0.417	0.429	0.058	0.730
T_{18}	0.347	0.389	0.049	0.630
T_{19}	0.357	0.391	0.050	0.655
T_{20}	0.363	0.392	0.051	0.685
C.D. (p=0.05)	0.009	0.008	0.001	0.017

See Table 1 for details

Table 5. Effect of micronutrients on speed of germination, seedling establishment (%) and mean emergence time in coriander

Treatments	Speed of germination	Seedling establishment (%)	Mean emergence time days
T_1	5.89	77.38	13.29
T_2	7.25	84.38	11.99
T_3	7.33	84.50	11.88
T_4	7.40	85.25	11.72
T_5	7.19	84.00	11.99
T_6	7.46	85.38	11.48
T_7	7.54	85.75	11.37
T_8	6.99	82.75	12.23
T_9	7.05	83.38	12.13
T_{10}	7.10	83.75	12.13
T_{11}	6.01	77.88	13.20
T_{12}	6.45	80.75	12.73
T_{13}	6.55	81.50	12.68
T_{14}	6.63	81.75	12.62
T_{15}	6.70	82.13	12.61
T_{16}	6.79	82.25	12.42
T_{17}	6.94	82.50	12.34
T_{18}	6.07	78.13	13.15
T_{19}	6.24	79.25	13.01
T_{20}	6.34	80.00	12.97
C.D. (p=0.05)	0.14	2.09	0.26

See Table 1 for detail

findings of Anitha et al (2015) in fenugreek and Maruthi and Paramesh et al (2016) in soybean.

CONCLUSION

Seed quality attributes of coriander seeds were significantly influenced by soil and foliar application of micronutrients. The treatment with soil application of 5 kg zinc sulphate/ha with recommended dose of fertilizers recorded maximum which were closely followed by soil application of 4 kg zinc sulphate/ha and soil application of 10 kg iron sulphate/ha. This study also revealed that soil application of micronutrients proved better as compared to foliar spray.

REFERENCES

Abd El-Ghany HM 2007. Wheat production under water-limited sandy soil conditions using bio-organic fertilizer systems. *Egyptian Journal of Agronomy* **29**(1): 17-27.

Abdul-Baki AA and Anderson JD 1973. Vigour determination in soybean by multiple criteria. *Crop Science* **90**(6): 112-117

Aebi HE 1983. Catalase. In Bergmeyer, H.U., Ed*., Methods of Enzymatic Analysis*, Verlag Chemie, Weinhem, pp 31-34.

Anitha M, Swami DV and Salomi DRS 2015. Seed yield and quality of fenugreek (*Trigonella foenum-graecum* L.) cv. lam methi-2 as influenced by integrated nutrient management. *The Bioscan* **10**(1): 103-106.

Anonymous 2017*. Horticultural Statistics at a Glance 2017*. Ministry of Agriculture & Farmers Welfare, Government of India. pp. 229.

Arvind PR, Vasudevan SN, Patil MG and Rajrajeshwari C 2012. Influence of NAA, triacontanol and boron spray on seed yield and quality of bitter gourd (*Momordica charantia*) cv. Pusa Visesh. *The Asian Journal of Horticulture* **7**(1): 36-39.

Chanchan M, Hore JK and Ghanti S 2013. Response of garlic to foliar application of some micronutrients. *Journal of Crop and Weed* **9**(2): 138-141.

Deepika C and Anita P 2016. Effect of zinc and boron on growth, seed yield and quality of radish (*Raphanus sativus* L.) cv. Arka Nishanth. *Current Agriculture Research Journal* **3**(1): 85-89.

Ellis RH and Roberts EH 1980. Improved equations for the prediction of seed longevity. *Annals of Botany* **45**: 13-30.

Giannopolitis CN and Reis SK 1977. Superoxide dismutase. I. Occurrence in higher plants. *Plant Physiology* **59**: 309-314.

Haque ME, Pual AK and Sarker JR 2011. Effect of nitrogen and boron on the growth and yield of tomato (*Lycopersicon esculentum*). *International Journal of Bio-resource and Stress Management* **2**: 277-282.

Iqbal N, Shahzad MAB and Khalil-ur-Rehman 2002. Evaluation of vigour and oil quality in cotton seed during accelerated ageing. *International Journal of Agricultural and Biosciences* **4**(3): 318-322.

ISTA 1999. International rules for seed testing. *Seed Sciences and Technology (Suppl.)* **23**: 1-334.

ISTA 2011. International Rules for Seed Testing. Chapter 5: The Germination Test. *International Seed Testing Association, Baserdorf, Switzerland*. ISBN 978-3- 906549-53-8.

Kittock DL and Law AG 1968. Relationship of seedling vigour to respiration and tetrazolium chloride reduction by germinating wheat seeds. *Agronomy Journal* **60**: 286-288.

Kumar ASH and Uppar DS 2007. Influence of integrated nutrient management on seed yield and quality of mothbean (*Vigna aconitifolia* Jacq. Marchel). *Karnataka Journal of Agricultural Sciences* **20**(2): 394-396.

Lal G, Singh B, Mehta RS and Maheria SP 2015. Performance of fenugreek (*Trigonella foenum-graecum* L.) as influenced by sulphur and zinc. *International Journal of Seed Spices* **5**(1): 29-33.

Maguire J D 1962. Speed of germination-aid in selection and evaluation for seedling emergence and vigour. *Crop Science* **2**: 176-177

Maruthi JB and Paramesh R 2016. Effect of integrated nutrient management on seed quality of vegetable soybean [*Glycine max* (L.) Merrill] cv. Karune. *Legume Research* **39**(4): 578-583.

Mousavi SR 2011. Zinc in crop production and interaction with phosphorus. *Australian Journal of Basic and Applied Sciences* **5**(9): 1503-1509.

Naga SK, Swain SK, Sandeep VV and Raju B 2013. Effect of foliar application of micronutrients on growth parameters in tomato (*Lycopersicon esculentum* mill.). *Journal of Agricultural and Food Chemistry* **1**: 146-151.

NHB 2018. Indian Horticulture Database 2018. National Horticulture Board, Gurgaon, India. pp.155

Panse VG and Sukhatme PV 1985. *Statistical Methods for Agricultural Workers*, *4th Ed., ICAR, New Delhi.*

Raissi A, Mohammad G, Mahmood R, Sayed RM and Mohammad NR 2012. Effects of phosphate bio-fertilizer, organic manure and chemical fertilizers on yield, yield components and seed capabilities of isabgol (*Plantago ovate). International Journal of Agricultural and Crop Science* **4**(24): 1821-1826.

Rithichai P, Sampantharat P and Jirakiattikul Y 2009. Coriander (*Coriandrum sativum* l.): Seed quality as affected by accelerated aging and subsequent hydropriming. *Asian Journal of Food and Agro-Industry* **1**: 217-221.

Santosh K 2012. Effect of micronutrients on quality of fruit and seed in tomato (*Solanum lycopersium* L.). *International Journal of Farm Sciences* **2**: 43-46.

Shannon LM, Kay E and Lew JY 1966. Peroxidase isoenzymes from horseradish roots. *The Journal of Biological Chemistry* **241**: 2166-2172.

Sheoran OP 2010. Online statistical analysis (OPSTAT) software developed by Chaudhary Charan Singh Haryana Agricultural University, Hisar, India. http://www.hau.ernet.in/opstat.html.

Siavoshi M and Shankar LL 2013. Organic fertilizers role on antioxidant enzymes in rice (*Oryza sativa* L.) *International Journal of Farming and Allied Sciences* **2**(2): 1337-1342.

Yogannand DK 2001. *Effect of mother plant nutrition and growth regulators on plant growth, seed yield and quality of Bell pepper cv. California Wonder.* M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.

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