

Effect of Front Line Demonstration on Micronutrients on Yield and Economic Viability of Coriander in Arid Region of Kachchh, Gujarat

Ramniwas^{*}, Manish Kanwat and S. R. Jat

ICAR-CAZRI, Krishi Vigyan Kendra, Kukma, Bhuj-Kutch-370105 (Gujarat)

ARTICLE INFO

Key words: Coriander, Chelated, Gross return, Impact, Micronutrient, Technology gap, Technology index

ABSTRACT

ICAR-CAZRI, Krishi Vigyan Kendra, Kukma, Bhuj conducted a field study on the micronutrient (Zn and Fe) influence through frontline demonstrations (FLDs) on the yield and economics of coriander cultivating farmers of different villages of Anjar and Bhuj Talukas in Kachchh, Gujarat during rabi 2016-17 to 2018-19. The foliar application of chelated Zn and Fe increased the seed yield and net income of the coriander cultivating farmers. The FLDs plots recorded an average yield ranging from 1750 to 2033 kg ha⁻¹ with a mean of 1862.67 kg ha⁻¹ compared to the local check (1616 kg ha⁻¹). The increased yield in demonstration plot ranged from 13.27 to 18.75% and 15.26% in average output. The average technology gap, extension gap and technology index were 264.6 kg ha⁻¹, 246.67 kg ha⁻¹ and 15.33%, respectively. Demonstration plots had a greater average net return (Rs. 70841.67) and B: C ratio (3.27) than farmer's practice where it was Rs. 57816.67 and 2.89, respectively. The current findings clearly suggest that by the spray of micronutrients, the grain yield and economics of coriander can be enhanced.

Introduction

Among the seed spices, coriander is the most important spice crop with multiple utility. It is an annual plant that belongs to member of the Apiaceae family possessing spice, aromatic, nutritional as well as medicinal properties (Diederichsen and Hammer, 2003; Khan *et al.*, 2014; Laribi *et al.*, 2015; Mandal and Mandal, 2015; McAusland *et al.*, 2020). The aromas and flavours have for many years attracted the attention of man is due to the presence of

pleasant aromatic odor essential oil rich in linalool found in the stem, leaves and fruits of coriander (Taneva *et al.*, 2016; Beyzi *et al.*, 2017). This is a remunerative cash crop planted primarily in India's arid and semi-arid regions during the winter season. Coriander production in India accounts for more than 80% of total production. In India, annual coriander seed production was 7,56,000 tonnes in 2019-20, grown on 6,29,000 ha with a productivity of 1202 kg ha⁻¹ (Anonymous, 2019-20). Gujarat came in third place in coriander production, with 2,18,093 tonnes

^{*}Corresponding author.

E-mail address: kanwatmanish@gmail.com (Manish Kanwat)

Received 28-08-2021; Accepted 07-12-2021

Copyright @ Journal of Extension Systems (acspublisher.com/journals/index.php/jes)

produced on 1,41,221 acreages at a productivity of 1540 kg ha⁻¹. The major districts in Gujarat where this crop is commercially farmed in considerable areas are Junagadh, Rajkot, Porbandar, Kutch, Amreli, Surendranagar, Morbi, and Gir Somnath. Coriander is grown on 2700 ha in the Kutch district, with a yield of 5130 MT and a productivity of 1540 kg/ha (Anonymous, 2020-21). In the fiscal year 2020-21, India exported coriander seeds worth 43.27 million USD to over 140 countries, earning foreign cash.

Micronutrient deficiency of zinc (Zn) and iron (Fe) is currently a major problem in developing countries due to the use of high-yielding varieties, intensive cropping systems, inadequate supplies of micronutrients and losses of organic matter content caused by erosion and pollution. Micronutrients are needed in small amounts for plant growth and development and their deficiency may lead to disruption in physiological and metabolism pathways in the plant (Nadi *et al.*, 2013). Micronutrients application plays an important role in the production of good quality and high yield of crops (Amjad *et al.*, 2014). The role of micronutrients in photosynthesis, N-fixation, respiration and other metabolic processes of the plant is well documented (Naga Sivaiah *et al.*, 2013). Zinc deficiency is most prevalent in developing countries, where the majority of the population consumes cereals as a staple food (Cakmark, 2008; Hacisalihoglu, 2020). The main soil factors affecting the availability of Zn are low total Zn contents, high pH, high calcite, and low organic matter contents. Zinc acts as an essential structural entity of numerous enzymes that participates in the metabolism of auxin and carbohydrates, in protein synthesis and in the structural integrity of the cell wall (Tsonev and Cibola Lidon, 2012). Furthermore, it has critical roles in pollen development, fertilization and chlorophyll synthesis (Hacisalihoglu, 2020; Karim *et al.*, 2012). Zinc application improves water use efficiency (Khan *et al.*, 2004), root structure and nitrogen fixation. Thus, Zn is an essential element for overall improvements in plant growth and nutrition status (Vadlamudi *et al.*, 2020). Iron (Fe) is also known to be an essential micronutrient for plants due to its participation in several metabolic processes such as photosynthesis and respiration (Pal *et al.*, 2019; Schmidt *et al.*, 2020). Foliar application of Zn through Zn-EDTA has increased the nutrient status in rice grains (Wei *et al.*, 2012). In wheat, the efficiency of a foliar application of Zn-EDTA was greater than that of ZnSO₄ in increasing Zn content (Brennan, 1996). Another report stated that in triticale, the application of Zn-EDTA was proved to be effective in increasing the agricultural output under drought stress (Kinaci and Gulmezoglu, 2007). Application of micronutrients significantly influenced the number of branches, umbels per plant, seeds per umbel and seed yield of coriander (Kalidasu *et al.*, 2008). Most

frequently, the amounts of Zn and Fe in the soil exceed the plants needs but cannot readily be absorbed by plants due to their presence in non-available forms or leaching losses. The best alternative is to apply these micronutrients in the form of foliar application.

Frontline demonstration (FLD) is one of these programmes, which focuses on increasing productivity by providing vital inputs as well as improved packages of practices that have been tested by scientists from ICAR Institutes and State Agricultural Universities (SAUs). The yields are higher when high yielding variety seed, recommended seed rate, seed treatment, planting time, appropriate fertiliser dose, weed control, and integrated pest and disease management are used, as opposed to farmer's practices (Nain *et al.*, 2011; Kumbhare *et al.*, 2014; Mukherjee, 2019; Singh *et al.*, 2019; Meena *et al.*, 2021). Other key aspects of this initiative include promoting the farming of improved varieties, receiving feedback from farmers concerning barriers to adoption of recommended improved technologies for further research, and maximising the technology diffusion process among farmers (Nagarajan *et al.*, 2001).

Methodology

The current study was conducted by the ICAR-CAZRI, Krishi Vigyan Kendra, Bhuj-Kutch (Gujarat) during the *rabi*, 2016-17 to 2018-19 at farmer's fields. A total of 50 frontline demonstrations were held throughout a 20.0 ha area in various villages of Anjar and Bhuj talukas in the Kutch district of the Gujarat state. Based on soil analysis, it was observed that soils was saline to alkaline in nature (7 to 9.0 pH) and low to medium in organic carbon (0.12-0.70%). Calcium carbonate content in soil varied from 0.5 to 25 %. Nitrogen and potassium in the soil varied from 169-301 and 134 to 500 kg/ha, with low to medium quantity of phosphorus. The micronutrients Zn and Fe were low to medium and varied from 1.02 to 8.88 kg/ha and 2.30 to 11.10 kg/ha, respectively. The FLDs were used to look at the differences in potential yield and demonstration yield, as well as the extension gap and technology index. In this impact study, yield data was obtained from FLD plots along with local farming practices widely used by farmers in this region, for comparative analysis. The sowing was carried out during first and second week of November by line sowing method at 30x15 cm (RXP). Before sowing the coriander seeds are treated with bio-pesticide *Trichoderma viridae* @10g/kg seed under shade. Under demonstration plots, we have provided the critical input micronutrients chelated forms of Zn and Fe (12%) as EDTA-Zn and EDTA-Fe for foliar spray @ 0.2 % at flowering and seed formation stage. During the whole cropping period we

provided technical guidance to the farmers on integrated crop management (ICM) practices such as seed treatment, lines sowing, weed management, irrigation management and integrated insect pest and disease control in the demo plots. Farmers, on the other hand, were allowed to continue with their conventional techniques in the event of a local check. During the off-campus trainings and field trips, KVK scientists assisted the demonstration farmers by demonstrating methods such as seeding in rows, spraying, weeding, and harvesting. The yield and economic performance of frontline demonstrations, the data on output were collected from FLDs as well as local plots and finally the grain yield, cost of cultivation, net returns with the benefit cost ratio were worked out.

Statistical tools such as frequency and percentage were used to collect, tabulate, and analyse the data. The extension gap, technology gap, and technology index were calculated using the Samui *et al.* (2000) equations.

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – yield under existing practice

Technology index = [(Potential yield – Demonstration yield)/Potential yield] x 100

Benefit cost ratio (BCR) = $\frac{\text{Gross return (Rs ha}^{-1}\text{)}}{\text{Total cost of cultivation (Rs ha}^{-1}\text{)}}$

Results and Discussion

Seed yield performance

The three years yield data shown in Table 1 revealed a comparison of the productivity level between demo yield and local check that FLD plots produced an average seed yield of 1862.67 kg ha⁻¹ in comparison to local check (1616 kg ha⁻¹) over three years pooled data. It was recorded that the additional average yield over local check was 246.67 kg ha⁻¹, with a percent increase yield over local check of 15.56 percent. The results clearly demonstrated that the positive influence of foliar application of micronutrients on higher average seed yields in demonstration plots over time compared to farmer's practice were achieved may be due to the improved ability of the crop to absorb nutrients, photosynthesis and better sink-source relationship as these play vital role in various biochemical processes. The increase in yield may be attributed to increased plant height, maximum number of umbels and umbellets, which were positively affected by the foliar application of micronutrients. Similar results are also found by Kalidasu *et al.*, 2008 and Singh, 2015 in coriander. Fluctuations in yield observed over the years were mainly on account of variation in climate, sowing time, pest and diseases attack. Similar enhancement in yield in coriander under FLDs was documented by Dhaka *et al.*, 2015; Lal *et al.*, 2016; Meena *et al.* 2016; Poonia *et al.* 2017 and Verma *et al.* (2016).

Table 1. Year wise details and yield performance of frontline demonstrations (Average of three years)

Year	No. of FLDs	Area (ha)	Yield (kg ha ⁻¹)		Additional yield over local check (kg ha ⁻¹)	Increased yield over local check (%)
			Demo Yield (IP)*	Check Yield (FP)		
2016-17	10	4.0	1805	1520	285	18.75
2017-18	20	8.0	2033	1783	250	14.66
2018-19	20	8.0	1750	1545	205	13.27
Average			1862.67	1616	246.67	15.56

*IP=Improved Practice; FP= Farmers Practice

Table 2. Extension gap, technology gap and technology index of coriander under FLDs

Year	No. of FLDs	Technology Gap (Kg ha ⁻¹)	Extension Gap (Kg ha ⁻¹)	Technology Index (%)
2016-17	10	395	285	17.95
2017-18	20	167	250	7.60
2018-19	20	450	205	20.45
Average		264.6	246.67	15.33

Yield gap analysis

The yield in FLDs and potential yield of the crop was compared for estimating yield gaps. These gaps were further categorized as technology and extension gaps. Technology gap indicates a gap in demonstration yield over the potential yield and this was 395, 167 and 450 kg/ha during 2016-17, 2017-18 and 2018-19, respectively (Table 2). The technology gap observed may be attributed to dissimilarities in soil fertility, salinity, quality of irrigation water, surrounding microclimate, insect-pests and disease risk, level of crop management by farmer, and others are responsible for the changes in this gap.

The data presented in the Table 2 showed the wide extension gap between demo and check varied between 205 and 285 kg ha⁻¹, with an average of 246.67 kg ha⁻¹, during the period under study. This large extension gap indicated that there was a need to raise awareness about the use of high-yielding varieties in conjunction with a better package of techniques in order to increase productivity. Greater use of the latest improved technologies applied to high yielding varieties can subsequently bridge this extension gap between demonstration yield and farmers yield

The extension gap was recorded at its lowest (205 kg ha⁻¹) in the concluding year 2018-19, indicating the greater adoption of superior technologies of the KVK. The findings of Bhoraniya et al. (2017), Lal et al. (2013), and Singh et al. (2011) corroborate the conclusions of this study. The acceptability and practicality of a technology are always inversely proportional to the technology index; the higher the acceptability of the demonstrated technology, the lower the technology index value (Sagar and Chandra, 2004). Over the years, the average technology index was 15.56 per cent. During the study period, the technology index showed that the intervened technology was widely accepted and viable by the farmers. The findings of Choudhary et al. (2018), Mishra et al. (2009), Dayanand et al. (2012) and

Chauhan et al. (2020) on the impact of FLDs in different crops are in agreement with the current studies.

Economic analysis

To assess their profit above existing technology, it is essential to compare the economic viability of any technique exhibited on farmers' fields. The cost of inputs and output statistics for coriander production under frontline demonstrations were gathered and analysed to determine gross return, net return, additional income, and the benefit cost (B:C) ratio. The outcomes of the economic analysis (Table 3) of coriander cultivation revealed that besides higher yield, participating farmers in FLDs realized a higher mean gross return of (Rs. 101975) and mean net returns (Rs. 70841.67) with an average benefit: cost ratio (3.27) compared to the local check. The results of the economic study point to the shown technology's increased profitability and economic feasibility. Kanwat et al., (2017), Poonia et al. (2017), Meena et al. (2016) and Singh et al. (2013) also found similar findings in coriander.

Conclusions

Based on the results of a three years impact study of frontline demonstrations on coriander crop, it is possible to conclude that productivity and economic returns can be increased by the adoption of balanced nutrition's in the crop. The use of micronutrients can contribute to high-quality coriander production at low cost. It may be beneficial in improving growers' attitudes, knowledge, and competence. It can be concluded that FLDs conducted under the close supervision of scientists are an important extension tool for illustrating newly released crop production technologies in the farmer's field in various agro-climatic regions and farming situations. FLDs serve a critical role in pushing farmers to adopt modern agricultural technology, resulting in increased output and income.

Table 3. Economic analysis of front-line demonstrations on coriander

Year	Cost of cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Additional Return (Rs/ha)	B:C Ratio	
	IP*	FP	IP	FP	IP	FP		IP	FP
2016-17	29500	28000	99275	83600	69775	55600	14175	3.37	2.99
2017-18	30600	29000	101650	89150	71050	57150	13900	3.32	2.79
2018-19	33700	32000	105000	86800	71700	60700	11000	3.12	2.90
Average	31266.67	29666.67	101975	86450	70841.67	57816.67	13025	3.27	2.89

*IP=Improved Practice; FP= Farmers Practice

References

- Amjad, A., Sajida, P., Syed, S., Muhammed, S., Zengqiang, Z., Fazil, W., Mohib, S., Shahida, B. and Abdul, M. (2014). Effect of foliar application of micronutrients on fruit quality of peach. *Am. J. Plant Sci.* 5, 1258-1264.
- Anonymous (2019-20). Area and production statistics of horticultural crops, National Horticulture Board, Government of India.
- Anonymous (2020-21). District-wise area and production of Horticultural crops, Directorate of Horticulture, Farmers Welfare and Co-operation Department, Government of Gujarat, Gandhinagar. <http://www.doh.gujarat.gov.in/statistics>.
- Beyzi, E., Karamanb, K., Gunesc, A. and Beyzid, S.B. (2017). Change in some biochemical and bioactive properties and essential oil composition of coriander seed (*Coriandrum sativum* L.) varieties from Turkey. *Ind Cro Prod.*, 109, 74-78.
- Bhoraniya, M.F., Chandawat, M.S. and Bochalya, B.C. (2017). Assessment of frontline demonstration on yield enhancement and economics of coriander (GC-4) in Surendranagar district of Saurashtra region of Gujarat. *Gujarat Indian J. Ext. Edu.*, 28(1), 14-17.
- Brennan, R.F. (1996). Effectiveness of different sources of manganese foliar sprays in alleviating manganese deficiency of *Lupinus angustifolius* L. grown on manganese deficient soils in Western Australia. *J. Plant Nutrition.* 19, 293-304.
- Cakmak, I. (2008). Enrichment of cereal grains with zinc: Agronomic or genetic biofortification? *Plant Soil.* 302, 1-17.
- Chauhan, R.S., Singh, R.K., Singh, P. and Singh. S.R.K. (2020). Impact Analysis of FLDs in Mustard on Technology Transfer and Productivity in Shivpuri District of M.P. *Indian Res. J. Ext. Edu.* 20(2&3), 79-82.
- Choudhary, M.L., Ojha, S.N. and Roat, B.L. (2018). Assessment of frontline demonstration on yield enhancement of fennel (Abu Sonf) under TSP area in Dungarpur, Rajasthan, *Int. j. seed spices.*, 8(1),46-49.
- Dayanand, Verma, R.K. and Mehta, S.M. (2012). Boosting the mustard production through front line demonstration. *Indian J. Ext. Edu.*, 12(3),121-123.
- Dhaka, B.L., Poonia, M.K., Meena, B.S. and Bairwa, R.K. (2015). Yield and economic viability of coriander under front line demonstrations in Bundi district of Rajasthan. *J. Hortl. Sci.*, 10(2), 226-28
- Diedrichsen, A. and Hammer, K. (2003). The intraspecific taxa coriander (*Coriandrum sativum* L.). *Genet. Resour. Crop Evol.*, 50,33-63.
- Hacisalihoglu, G. (2020). Zinc: The last nutrient in the alphabet and shedding light on Zn efficiency for the future of crop production under suboptimal Zn. *Plants.* 9,1471.
- Kalidasu, G., Sarada, C. and Yellamanda, R. T. (2008). Influence of micronutrients on growth and yield of coriander (*Coriandrum sativum*) in rainfed vertisols. *J. Spices Aromatic crops* 17, 187-189.
- Kanwat, M, Meena, N.R. and Meena, N.K. (2017). Factors Influencing in Ajwain Cultivation in Chittorgarh District of Rajasthan, India. *Int.J.Curr.Microbiol.App.Sci.* 6(12),3817-3822
- Karim, M., Zhang, Y.Q., Zhao, R.R., Chen, X., Zhang, F., and Zou, C. (2012). Alleviation of drought stress in winter wheat by late foliar application of zinc, boron, and manganese. *J. Plant Nutrition Soil Sci.* 175, 142-151.
- Khan, H. R., McDonald, G. K. and Rengel, Z. (2004). Zinc fertilization and water stress affects plant water relations, stomatal conductance and osmotic adjustment in chickpea (*Cicer arietinum* L.). *Plant Soil.* 267,271-284.
- Khan, I.U., Dubey, W. and Gupta, V. (2014). Taconomical Aspect of Coriander (*Coriandrum sativum* L.). *Int. J. Curr. Res.*, 6(11), 9926-9930.
- Kinaci, E. and Gulmezoglu, N. (2007). Grain yield and yield components of triticale upon application of different foliar fertilizers. *Interciencia.* 32, 624-628.
- Kumbhare N.V., Dubey S.K., Nain M.S. and Bahal R. (2014). Micro analysis of yield gap and profitability in pulses and cereals. *Legume Research- An International Journal.* 37(5),532-536.
- Lal, G., Mehta R.S., Singh, D. and Chaudhary, M.K. (2013). Effect of technological interventions on coriander yield at farmers' field. *Int. J. Seed Spices.*, 3(2), 65-69.
- Lal, G., Mehta, R.S., Meena, R.S., Meena, N.K. and Choudhry, M.L. (2016). Impact of front line demonstration (FLDS) on yield enhancement of coriander: A case study in TSP area of Pratapgarh. E News Letter ICAR- National Research Centre on Seed Spices, 8(3),5-6.
- Laribi, B., Kouki, K., M'Hamdi, M. and Bettaieb, T. (2015). Coriander (*Coriandrum sativum* L.) and its bioactive constituents. *Fitoterapia.*, 103, 9-26.
- Mandal, S., and Mandal, D. (2015). Coriander (*Coriandrum sativum* L.) essential oil: Chemistry and biological activity. *Asian Pac. J. Trop. Biomed.*, 5(6), 421-428.
- McAusland, L., Lim, M.T., Morris, D.E., Smith-Herman, H.L., Mohammed, U., Hayes-Gill, B.R., Crowe, J.A., Fisk, I.D. and Murchie, E.H. (2020). Growth Spectrum Complexity Dictates Aromatic Intensity in Coriander (*Coriandrum sativum* L.). *Front. Plant Sci.*, 11, 462.
- Meena, K.C., Singh, D. K., Gupta, I. N., Singh, B. and Meena, S. S. (2016). Popularization of coriander production technologies through front line demonstrations in Hadauti region of Rajasthan. *Int. J. Seed Spices.*, 6(2),24-29.

- Meena M. L., Singh Pushpa, Kundu M. S. (2021). FLDs on Turmeric (Rajendra sonia) in Muzaffarpur, Bihar: Adoption Horizontal Spread and Satisfaction Level, *Indian Journal of Extension Education*, 57(4),58-62.
- Mishra, D.K., Paliwal, D.K., Tailor, R.S. and Deshwal, A.K. (2009) Impact of Frontline Demonstrations on Yield Enhancement of Potato. *Indian Res. J. Ext. Edu.* 9(3), 26-28.
- Mukherjee Dhiman (2019). Strategy of Improving Wheat (*Triticum aestivum* L.) Productivity under New Alluvial Zone through Demonstration Programme. *Indian Journal of Extension Education*, 55(4) ,66-70.
- Nadi, E., Ayneband, A. and Mojaddam, M. (2013). Effect of nano-iron chelate fertilizer on grain yield, protein percent and chlorophyll content of faba bean (*Vicia faba* L.). *Int. J. Bioscience.* 3, 267–272.
- Naga, S. K., Swain, S.K., Sandeep, V. V. and Raju, B. (2013). Effect of foliar application of micronutrients on growth parameters in Tomato (*Lycopersicon esculantum* mill). *J. Agric. Food Sci.* 1, 146-151.
- Nagarajan, S., Singh, R.P., Singh, R., Singh, S., Singh, A., Kumar, A. and Chand, R. (2001) Transfer of technology in wheat through front line demonstration in India, A comprehensive report, 1995- 2000, directorate of wheat Research Karnal-132001, *Research Bulletin*, 6, 21.
- Nain M. S., Singh R., Vijayraghavan, K. and Vyas A. K. (2012). Participatory linkage of farmers, technology and agricultural researchers for improved wheat production in national capital region of India. *African Journal of Agricultural Research.* 7 (37), 5198-5207. 10.5897/AJAR12.1538
- Pal, V., Singh, G. and Dhaliwal, S. (2019). Yield enhancement and biofortification of chickpea (*Cicer arietinum* L.) grain with iron and zinc through foliar application of ferrous sulfate and urea. *J. Plant Nutrition.* 42, 1789–1802.
- Poonia, M. K., Singh, M., Dhaka, B. L., Bairwa, R. K. and Kumhar, B.L. (2017). Impact of Front-Line Demonstration on the Yield and Economics of Coriander in Kota District of Rajasthan, India. *Int. J. Curr. Microbiol. App. Sci.* 6(3), 2344-2348.
- Sagar, R.L. and Chandra, R. (2004). Front line demonstration on sesame in West Bengal. *Agric. Ext. Review*, 16(2), 7-10.
- Samui, S.K., Maitra, S., Roy, D. K., Mandal, A.K. and Saha, D. (2000). Evaluation of front-line demonstration on groundnut. *J. Indian Soc. Coast. Agric. Res.*, 18 (2), 180-183.
- Schmidt,W., Thomine, S. and Buckhout, T.J. (2020). Iron nutrition and interactions in plants. *Front. Plant Sci.* 10, 1670.
- Singh D., Meena M.L. and Choudhary M.K. (2011). Boosting seed spices production technology through front line demonstrations. *Int. J. Seed Spices.*, 1(1), 81- 85.
- Singh, K. K., Singh, R. P. N., Mishra D., and Chauhan D. (2019). Evaluation of Front Line Demonstration of Pulses in Raebareli District. *Indian Journal of Extension Education*, 55(4) ,66-77-80.
- Teneva, D., Denkova, Z., Goranov, B., Denkova, R., Kostov, G., Atanasova, T. and Merdzhanov, P. (2016). Chemical composition and antimicrobial activity of essential oils from black pepper, cumin, coriander and cardamom against some pathogenic microorganisms. *Food Technol.*, 2, 39–52.
- Tsonev, T. and Cebola Lidon, F.J. (2012). Zinc in plants-an overview. *Emirates J. Food Agric.* 24: 322–333.
- Vadlamudi, K., Upadhyay, H., Singh, A. and Reddy, M. (2020). Influence of zinc application in plant growth: An overview. *Eur. J. Mol. Clin. Med.*7,2321–2327.
- Verma, A. K., Singh, M., Singh, N., Jeenger, K.L. and Verma, J.R. 2016. Dissemination of improved practices of coriander through FLDS in Zone V of Rajasthan province. *Int. J. Sci. Environ. Tech.*, 5(5), 3320-27.
- Wei, Y., Shohag, M. J. I., Yang, X. and Yibin, Z. (2012). Effects of foliar iron application on iron concentration in polished rice grain and its bioavailability. *J. Agric. Food Chem.* 60, 11433–11439.