CHAPTER – II
REVIEW OF LITERATURE

This chapter covers the literature on growth and yield attributes, yield, nutrient content and uptake and economics as well as to fill up the research gap, other related and relevant references have been briefly reviewed under appropriate sub heading.

2.1 Effect of zinc and iron on growth, yield attributes and yield

2.2 Effect of zinc and iron on nutrient content and uptake

2.3 Effect of zinc and iron on economics

2.1 Effect of zinc and iron on growth, yield attributes and yield

Maurya (1990) reported that micronutrient application of CuSO₄ and ZnSO₄ increased the yield of coriander fruits in respect of Cu and Zn to 28 and 23.21 %, respectively, essential oil content of coriander seeds were also increased, also recorded improvement in coriander grain yield with 0.2% FeSO₄ foliar spray.

Gour (1994) observed that application of zinc as soil (5 kg/ha) as well as foliar (0.5%) or both were recorded significantly higher seed and straw yield of fennel.

Gupta (1994) recorded significantly higher seed and straw yield of fennel over control with the application of zinc as soil as well as foliar spray or both.

Verma (1997) found significant increase in plant height, dry matter accumulation, branches per plant of coriander with application of zinc sulphate @ 20 kg/ha over control.

Singh (1998) conducted a field experiment and reported that plant height, dry matter accumulation and branches per plant of coriander were increased significantly with application of 4 kg Zn/ha over control and application of 2 kg Zn/ha.

Khattab and Umer (1999) reported increase in plant growth, yield and essential oil content of coriander by the application of micronutrients, they also noticed that trace element in dry fruits were also increased with increasing the fertilizer treatment.
Singh and Jat (2002) working on doses of zinc (0, 2, 4 and 6 kg/ha) with varying levels of phosphorus (0, 15, 30, 45, 60 kg P₂O₅ /ha) under semi-arid conditions of Jobner, reported that application of 4 kg Zn/ha significantly increased the plant height, dry matter accumulation and branches per plant in coriander.

Meena (2003) recorded significant increase in yield attributes and yield of fenugreek with application of zinc as soil as well as foliar spray.

Narolia (2004) observed that application of 5 kg Zn/ha significantly increased spikes per plant, seeds per spike, seed and straw yield of isabgol crop over both control and 2.5 kg Zn/ha.

Manaria (2005) reported that application of N, P, K, S, Zn treatments gave significantly higher dry matter yield per plant at successive stages of crop growth, number of branches per plant, plant height, total chlorophyll content of leaves at 80 DAT and yield attributes of fennel.

A pot experiment on fenugreek was conducted by Jakhar (2006) during rabi season of 2005-06 in greenhouse, at Jobner and reported that increasing levels of zinc (0, 10 and 20 mg/kg) significantly increased the plant height, number of pods per plant, number of seeds per pod, test weight, seed and straw yield of fenugreek.

Sharma (2006) found that application of 40 kg FeSO₄ significantly increased growth and yield parameter of fenugreek.

Chhibba et al. (2007) observed that the seed yield of methi significantly increased with soil application of 40 kg FeSO₄ as well as spray of 0.5% FeSO₄ over control.

Fatima et al. (2007) reported that application of fertilizer fritz showed positive impact on the yield of plants as a whole and on their constitutive parts. Yield of Coriandrum sativum was significantly high ranged between 45-95%. The possible reason could be that fertilizer fritz may have provided balanced level of the micronutrients required for different physiological and biochemical processes in Coriandrum sativum which had resulted in the maximum yield in all respect.
Sammauria (2007) observed that seed, straw and biological yields, pod length and test weight of fenugreek were significantly higher with the application of 5.0 kg Zn/ha over control.

Kalidasu et al. (2008) reported that coriander respond well to micronutrients. Foliar spray of micronutrients was advantageous over soil application because of rapid response, effectiveness and elimination of deficiency symptoms. It can be concluded that the foliar application of 0.5% FeSO₄ significantly enhanced the growth, seed yield and quality of coriander in the calcareous soils of Coimbatore.

Mahorkar et al. (2008) noted that the treatment with Zn at 0.5%+Fe at 0.5%+Humic acid 0.05% exhibited the maximum value of all vegetative parameters, i.e. plant height, number of branches per plant and leaf area per plant, as well as green leaf yield of fenugreek.

Sammauria and Yadav (2008) reported that application of 5.0 kg Zn/ha as basal dose significantly increased number of pods per plant, seed, straw and biological yield, whereas, branches per plant increased up to the level of Zn 7.5 kg/ha and seeds per pod and test weight of fenugreek only up to 2.5 kg Zn/ha level.

Pariari et al. (2009) result showed that foliar application of boron @ 0.1% and zinc @ 0.2% twice had been found to be effective in enhancing most of the yield attributes and seed yield of fenugreek. It is also observed that lower concentration is more effective than higher concentration.

Said and Omer (2009) reported that coriander plants sprayed with 200ppm zinc + 200 ppm iron gave the highest content of essential oil in vegetative and flowering stages. The highest yields of both seeds and straw obtained by spraying of 400ppm zinc and 400ppm iron.

Sharangi et al. (2009) found the positive effect of single or combined foliar application of 0.1 and 0.2% boron and 0.2 and 0.4% Zinc on the yield and yield components of fennel whereas spraying with 0.2% Zinc resulted in the highest increase in plant height and number of umbels per plant.
Singh et al. (2009) reported that application of ZnSO$_4$ @ 20 kg/ha produced significantly higher plant height, number of primary and secondary branches per plant of coriander over control.

Yadav et al. (2009) conducted an experiment on effect of micronutrients in combinations with organic manures on production and net returns of sesame at Bundelkhand tract of Uttar Pradesh. They observed that application of 100 per cent RDF + 25t FYM/ha + 20 kg/ha ZnSO$_4$ + 25 kg/ha FeSO$_4$ increased 1000 seed weight, seed yield (3.75g, 958 kg/ha) as compared to control (2.35g, 501kg/ha).

Sammauria and Yadav (2010) conducted a field experiment on fenugreek (Trigonella foenum-graecum) –pearlmillet (Pennisetum glaucum) cropping sequence and reported that application of 5.0 kg Zn/ha resulted in 14.7 % higher seed yield of fenugreek compared with control.

Khalid (2012) reported that NP + trace elements had a significant effect on anise, coriander and sweet fennel plants which positively affect on growth and chemical constituent’s of these plants grow under arid regions in Egypt.

Shabanzadesh and Galavi (2011) found that the foliar application of Micronutrients(B, Zn, Fe) significantly affected plant height, capsule number per plant, number of seeds per plant and capsule, grain and biological yield and harvest index. The differences amongst micronutrients spraying treatments and the control were significant for all above mentioned traits. Foliar application with the mixture of three micronutrients (B,Zn and Fe) resulted in the greatest grain yield of black cumin.

Ramezani et al. (2012) result concluded that Interactions of salinity and foliar application of micronutrients (including the control, Fe, Zn and Fe + Zn with concentrations of 0.03% for Iron and 0.04% for Zinc) like, Iron and Zinc on seed yield and yield components was significant in ajowan. Although water use efficiency decreased under salinity condition but foliar application had no significant effect on WUE. Totally foliar application at high salinity did not affect on seed yield but in average salinity decreased the yield and in no salt conditions, increased the seed yield.

Choudhary et al. (2014) conducted an experiment to study the effect of biofertilizers and micronutrients on growth and yield of garlic var. G-282. The results revealed that application of PSB + ZnSO4 @ 0.4 per cent was recorded maximum
plant height at 60 days and 130 days after sowing (48.83 cm and 77.30 cm) compared to control (37.73 and 64.33 cm).

Lal et al. (2014) reported that varying levels of foliar application of zinc did not significant influence plant height. The highest number of primary branches of plant, number of umblets of umbel and seed yield were obtained with foliar application of 0.6% zinc. Basal application of sulphur @40 kg/ha along with foliar application of 0.6% zinc is better for realizing higher yield of coriander.

Choudhary et al. (2015) conducted an experiment to study the effect of soil and foliar application of zinc and iron on yield, quality and economics of fennel. The results revealed that foliar application of ZnSO$_4$ @ 0.5 per cent + FeSO$_4$ @ 0.5 per cent increased umbels/plant, seeds/umbels, test weight and seed yield (28.08, 195.13 and 3.91g, 12.61q/ha) as compared to control (22.99, 169.60 and 3.73g, 12.61 q/ha).

Diana and Nehru (2015) studied the impact of micronutrient application in coriander cv.CO4 and revealed that the spraying of FeSO$_4$ at 0.5 per cent gave maximum number of umbels, 100 seed weight and seed yield (33.7, 1.55 g and 623.3 kg/ha) per plant as compared to control (17.9, 1.35 g and 459.9 kg/ha).

Ganesh et al. (2015) conducted an experiment to study the effect of biofertilizers and micronutrients on morphophysiological and biochemical parameters of groundnut. The results revealed that application of RDF + Mo + Zn + Rhizobium + PSB at 30, 60 and 90 DAS resulted in maximum plant height and Number of branches per plant ( 8.49, 19.09 and 25.89 cm) (7.2, 8.7 and 10.14) as compared to control (6.87, 15.22 and 16.89cm) (5.1, 6.3 and 7.22).

Sinta et al. (2015) reported that coriander responded well to micronutrients. Foliar spray of micronutrients was advantageous over soil application because of rapid response, effectiveness and elimination of deficiency symptoms. It can be concluded that the foliar application of 0.5% FeSO$_4$ significantly enhanced the growth, seed yield and quality of coriander in the calcareous soils of Coimbatore.

2.2 Nutrient content and uptake

Gour (1994) revealed that application of zinc and iron soil or foliar spray or both significantly increased N, K and Zn content in seed and straw of fennel and soil
Review of Literature

application of zinc decreased P and Fe content in seed and straw. While, uptake of N, P, K, Zn and Fe increased by application of zinc either mode of application over control. Similar results were also recorded in fennel crop by Gupta (1994).

Singh (1998) conducted a field experiment at Jobner and reported that N and Zn concentration in seed and straw of coriander increased significantly with application of 6 kg Zn/ha over 0 and 2 kg Zn/ha but phosphorus concentration in seed and straw decreased significantly over control.

A significant increase in nitrogen, potassium and zinc content of seed and straw of fenugreek was recorded with the application of zinc up to 7.5 kg Zn/ha applied as basal, however, phosphorus content increased significantly only up to application of 2.5 kg Zn/ha and their by decreased significantly with every increase in the level of zinc application and same trend was also observed in the total uptake of these nutrients (Meena, 2003).

Narolia (2004) reported that application of 5 kg Zn/ha significantly increased N and Zn concentration in seed and straw of isabgol and their uptake by crop as compared to control and treatment 2.5 kg Zn/ha.

Sharma (2006) found that application of 40 kg FeSO₄ significantly increased nutrient (nitrogen, phosphorus, potassium, sulphur and iron) uptake of fenugreek crop.

Sammauria (2007) at Bikaner observed that soils as well as foliar spray of zinc significantly increased N and Zn content in seed and straw of fenugreek, While, P content was decreased with soil application of zinc. The uptake of N, P, K and Zn significantly increased with soil or foliar spray over control.

2.3 Economics of different treatments

Kumawat (1999) revealed that application of 3 kg Fe/ha recorded significantly higher net returns compared to control.

Significantly, highest net returns and B: C ratio of fenugreek was recorded with the application of 7.5 kg Zn/ha (Meena, 2003).
Manaria (2005) reported that maximum net returns and B: C ratio of fennel with the application of N, P, K, S and Zn treatments, which was significantly higher over NPK, NPKZn and NPKS during both the years.

Sharma (2006) reported that application of vermicompost 2.5 t/ha + potash @ 20 kg/ha + iron @ 40 kg/ha recorded highest net returns and B:C ratio compared to lower doses of iron in combination with same dose of vermicompost + potash.

Singh et al. (2009) recorded significantly higher net returns and B: C ratio of coriander with the application of 20 kg Zn/ha as compared to control.

Yadav et al. (2009) conducted an experiment on effect of micronutrients in combinations with organic manures on production and net returns of sesame at Bundelkhand tract of Uttar Pradesh. They observed that application100 per cent RDF + 25t FYM/ha + 20 kg/ha ZnSO₄ + 25 kg/ha FeSO₄ gave maximum Net returns (19134 Rs/ha) compared to control (7427Rs/ha).

Sammanuria and Yadav (2010) conducted a field experiment on fenugreek (Trigonella foenum-graecum) –pearlmillet (Pennisetum glaucum) cropping system and reported that the highest net returns and B: C ratio were in 7.5 kg Zn/ha.

Gupta (2012) reported that significantly higher net returns and B: C ratio was recorded with the application of 6 kg Zn/ha in fennel.

Singh (2015) reported that two foliar sprays of ferrous sulphate applied @0.5% at 45 and 60 days after sowing resulted into maximum coriander plant height, yield and the highest return and the benefit: cost ratio.

Kamrozzaman et al. (2016) reported that a package of 100% soil test based dose of chemical fertilizer (N₁₁₈ P₄₀₇ K₂₆ S₁₀ Zn₂₂ B₀₉ kg/ha) may be recommended for the cultivation of coriander in low Ganges river flood plain soil for higher yield with economic profitability.