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Effect of zinc and manganese on growth and yield of turnip (*Brassica rapa*)

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Abstract

A field experiment entitled “Effect of Zinc and Manganese on Growth and Yield of Turnip (*Brassica rapa*)” was conducted in Rabi season during the year 2024-25 at the experimental field of Department of Horticulture, Faculty of Agriculture, Tanta University, Sri Ganganagar, Rajasthan. A field experiment was laid out in randomized block design with 7 different treatments and 3 replications. Observation on growth attributes were recorded at 30, 45 and 60 DAS. The results revealed that (T6 - ZnSO₄ 400 ppm/L + MnSO₄ 400 ppm/L) consistently outperformed other treatments, recording highest plant height (17.44cm, 21.11 cm and 29.88 cm), Number of leaves - (4.98, 5.76 and 8.73), Length of leaves (15.88cm, 18.43cm and 25.14cm), Width of leaves (6.52cm, 8.42cm and 13.73cm). It may be concluded that the integration of ZnSO₄ + MnSO₄ significantly enhanced the growth and yield attributes of Turnip under the agro - climatic conditions of Rajasthan.

Keywords: Zinc sulphate, Manganese sulphate, Turnip growth, Yield attributes, Randomized block design

Introduction

India is the second largest producer of vegetable crops after China in the world. Due to wide range of diverse agroclimatic conditions, India is growing different types of vegetables throughout the year. Vegetables are edible parts of plants like roots, stems, leaves, flowers, and fruits that are consumed for their nutritional benefits. They are rich in vitamins, minerals, fibre, and antioxidants.

Turnip (*Brassica rapa subsp. rapa*) is one of the key root crops of the group Brassicaceae, widely grown and consumed in different forms. Turnip is commonly grown in northern parts of India. It prefers cool and moist weather, with an ideal temperature of 10°C to 25°C. High temperatures can reduce root quality and cause early flowering. It grows well in short day length and requires plenty of sunlight for proper root development. Too much heat or drought can lead to hard or fibrous roots.

The turnip plant has green, lobed leaves that grow in a rosette form from the base. It produces a fleshy, rounded root just below or partly above the soil surface. In its second year (if not harvested), it can produce yellow, cross-shaped flowers. The edible part of the turnip is its swollen taproot, which is harvested in its first year of growth. This part is often white or purple and has a mild, sweet flavour. In some cases, the young green leaves (called turnip greens) are also used as leafy vegetables. Both parts are nutritious and used in many dishes. Turnip stores food in its modified taproot, which becomes enlarged and succulent. This root is rich in water and starch and is consumed after boiling, roasting, or pickling. It's often used in winter diets, especially in curries and stews. The root's texture and flavour make it suitable for both raw and cooked consumption (Mekki, 2014) ^[5].

Turnip is low in calories but rich in fibre, which helps in digestion and weight management. It provides Vitamin C, potassium, calcium, and small amounts of iron and magnesium. The leafy tops contain even more nutrients, including Vitamin A, Vitamin K, and folate. The 100g turnip has 34 calories, 0.12% fat, 7.84 % carbohydrates, 2.2% fibres, 1.10% protein. The turnips leaves are high in vitamin K and calcium. Furthermore, the turnip roots provide carbohydrates (4.4 g), dietary fibre (3.5 g), fat (0.2 g), protein (1.1 g), vitamin A, Vitamin B9, Vitamin B6, Vitamin K, calcium and sugars. It is a good vegetable for maintaining heart and bone health (Saad, 2014) ^[7].

Vegetables need both macronutrients like N, P, K, and micronutrients like Zinc, Iron, Manganese, and Boron. Macronutrients support the overall structure, energy transfer, and cell growth. Micronutrients, though needed in small amounts, play critical roles in enzyme activation, flowering, root development, and resistance against stress. Manganese helps in photosynthesis, nitrogen metabolism, and enzyme function. It is particularly important for the formation of chloroplasts and disease resistance. In turnip, manganese ensures proper leaf colour and supports healthy root formation. Manganese deficiency appears as a patchy fading of the leaf on immature leaves. Veins remain green, while interveinal regions become light green to yellow. White patches might also be detected between veins in severe circumstances. To address any shortfall, Mn foliar sprays with zinc are commonly used. Mn and Zn interact strongly; plants lacking in Mn will have high Zn levels, and vice versa.

Zinc is essential for enzyme activation, hormone balance, and leaf expansion. In turnip, zinc helps in better chlorophyll formation and improves root development. Zinc deficiency can lead to stunted growth and yellowing of leaves. Zinc sulphate is commonly applied at around 25-30 kg/ha to ensure healthy growth. Zn is necessary for the control and maintenance of gene expression required for plant abiotic stress tolerance. Its insufficiency causes anomalies in plants, which manifest as deficient signs such as stunted growth, chlorosis and reduced leaves, as well as spikelet sterility. Zinc deficiency can also alter the quality of harvested goods; increase the vulnerability of plants to harm caused by strong light or temperature intensity and makes them more susceptible to fungal infections. Zinc is necessary for the synthesis of tryptophan, which in turn is a precursor to IAA and it also plays a role in the creation of auxin, a vital growth hormone (Samad, 2011)^[8].

Materials and Methods

The experiment was performed during winter season of 2024-25 at experimental field of Department of

Horticulture, Faculty of Agriculture, Tanta University, Sri Ganganagar, Rajasthan. The field experiment was carried out with 7 treatments and 3 replications laid out in Randomized Block Design consisting treatment combination T1 - (ZnSO₄ 200 ppm/L), T2 - (ZnSO₄ 400 ppm/L), T3 - (MnSO₄ 200 ppm/L), T4 - (MnSO₄ 400 ppm/L), T5 - (ZnSO₄ 200 ppm + MnSO₄ 200 ppm/L), T6 - (ZnSO₄ 400 ppm + MnSO₄ 400 ppm/L), T7 - (Control). The net plot size was 4 m × 4m. Turnip was sown on 14 November, 2024 with a spacing of 30 cm × 15 cm and harvested on 20th January, 2025. Standard agronomic practices including irrigation and weed management were followed uniformly across all plots throughout the crop growth period. Growth parameters were recorded at various stages which was starting from 30 DAS, 45 DAS, 60 DAS and at the time of harvesting. The growth parameters like plant height, number of leaves per plant, leaf length and leaf width were recorded. 5 plants per plot from each treatment were selected randomly and the observations were recorded. After recording observations, average mean of selected 5 plants was calculated out.

Results and Discussion

Growth Parameters

The growth parameters such as plant height, number of leaves plant, leaf length and leaf width was significantly influenced by the T6 treatment. The treatments combination of Zinc and Manganese showed the improved growth parameters over the rest of treatments. The Plant height was found Maximum (17.44, 21.11, 29.88 cm at 30,45,60 DAS), The Number of leaves per plant was found Maximum (4.98, 5.75, 8.73 cm at 30,45,60 DAS). The Length of leaves per plant was found Maximum (15.88, 18.43, 25.14 cm at 30,45,60 DAS), The Width of leaves per plant was found Maximum (6.52, 8.42, 13.73 cm at 30,45,60 DAS) were recorded in treatment (T6) (ZnSO₄ 400 ppm + MnSO₄ 400 ppm/ L) which gave the highest values in all growth parameters.

Table 1: Effects of Zinc and Manganese on Growth of Turnip

	Plant Height (cm)			Number of leaves			Length of leaves (cm)			Width of leaves (cm)		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T1 - ZnSO ₄ 200 ppm/L	13.76	16.01	25.07	4.26	4.77	6.98	12.65	13.63	21.11	5.08	6.63	10.62
T2 - ZnSO ₄ 400 ppm/L	13.97	16.12	25.13	4.31	4.96	7.48	13.24	15.67	22.67	5.14	6.77	10.77
T3 - MnSO ₄ 200 ppm/L	15.44	17.26	26.29	4.42	5.36	7.79	14.04	16.89	23.46	5.44	7.54	11.94
T4 - MnSO ₄ 400 ppm/L	16.12	18.19	27.76	4.76	5.61	7.96	14.68	17.76	24.33	5.68	7.76	12.92
T5 - ZnSO ₄ 200 ppm + MnSO ₄ 200 ppm/L	17.31	20.87	28.12	4.95	5.70	8.55	15.43	18.43	24.73	5.88	7.94	13.22
T6 - ZnSO ₄ 400 ppm + MnSO ₄ 400 ppm/L	17.44	21.11	29.88	4.98	5.76	8.73	15.88	18.76	25.14	6.52	8.42	13.73
T7 - Control	11.31	14.13	23.19	3.76	4.10	5.73	10.54	13.42	20.89	4.80	6.06	9.09
S.Em. ±	0.17	0.27	0.35	0.06	0.03	0.11	0.69	0.82	0.64	0.21	0.31	0.63
CD (P=0.05)	0.55	0.85	1.08	0.18	0.09	0.33	0.55	0.85	1.08	0.55	0.85	1.08

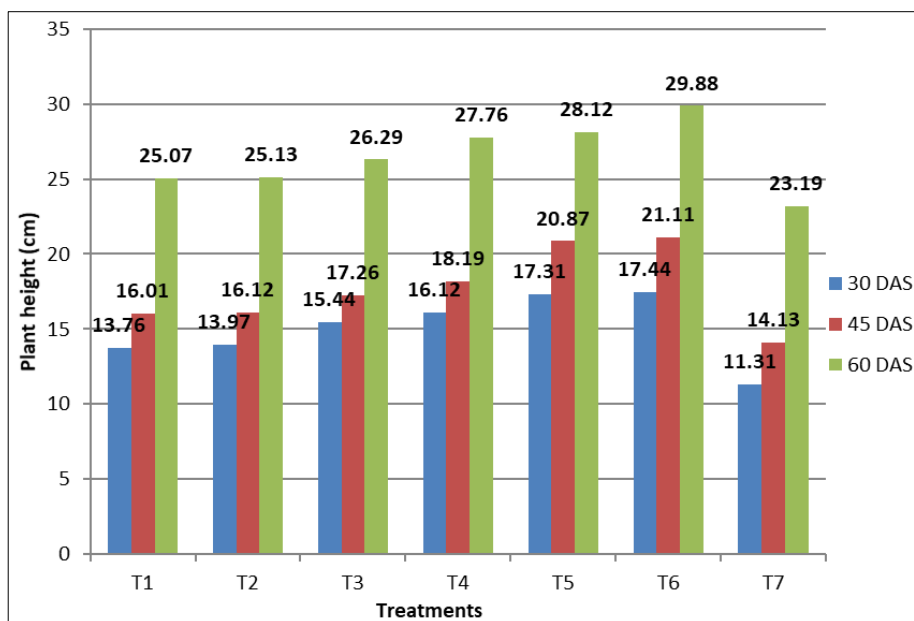


Fig 1: Effects of Zinc and Manganese on Plant height (cm) of Turnip

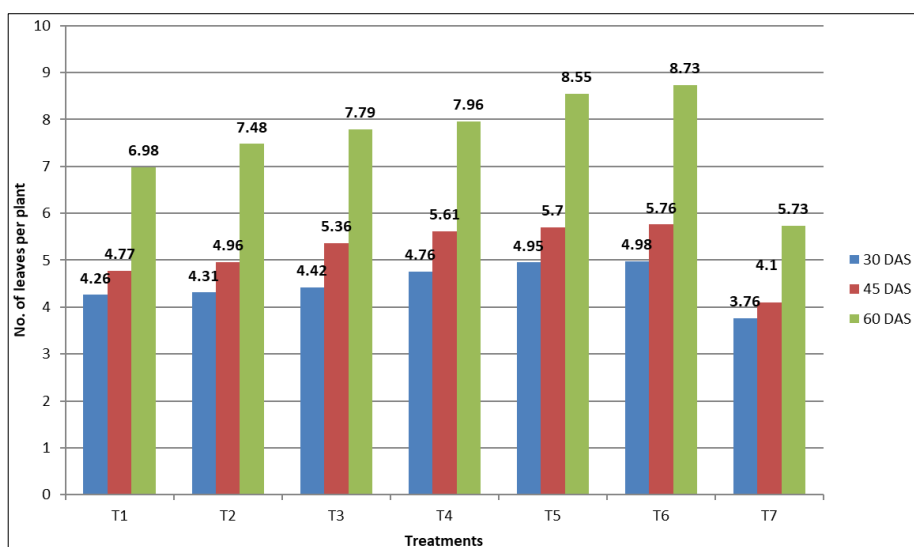


Fig 2: Effects of Zinc and Manganese on No. of leaves of Turnip

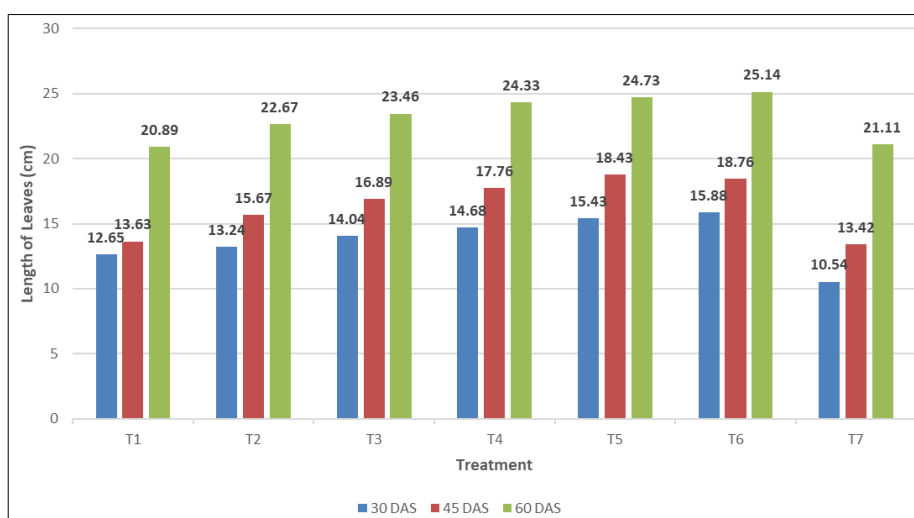


Fig 3: Effects of Zinc and Manganese on Length of leaves (cm) of Turnip

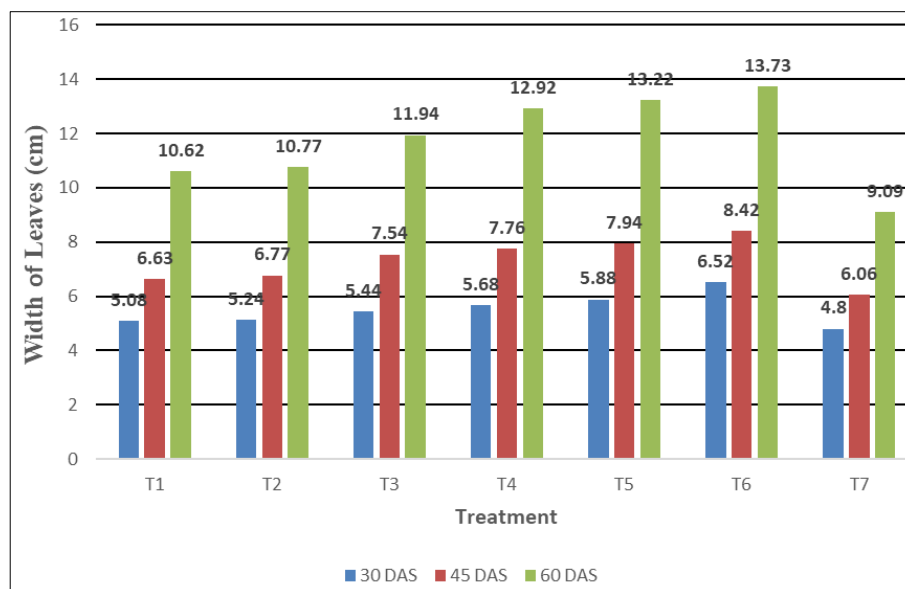


Fig 4: Effects of Zinc and Manganese on Width of leaves (cm) of Turnip

Discussion

Growth parameters

The effect of zinc and manganese was found significant on number of leaves per plant, plant height, number of branches. It significantly influenced plant height (cm) at 30, 45 and 60 DAS, no. of leaves per plant at 30, 45 and 60 DAS, Figure.1 Effects of Zinc and Manganese on Plant height (cm) of Turnip. The Plant height was found Maximum (17.44, 21.11, 29.88 cm at 30,45,60 DAS) in T6 (ZnSO₄ 400 ppm+ MnSO₄ 400 ppm/ L) and minimum was found (11.31, 14.13, 23.19 cm at 30,45,60 DAS) in T7 (control). Figure.2 Effects of Zinc and Manganese on No. of leaves of Turnip. The Number of leaves per plant was found Maximum (4.98, 5.75, 8.73 cm at 30,45,60 DAS) in T6 (ZnSO₄ 400 ppm+ MnSO₄ 400 ppm/ L) and minimum was found (3.76, 4.10, 5.73 cm at 30,45,60 DAS) in T7 (control). Figure.3 Effects of Zinc and Manganese on Length of leaves (cm) of Turnip. The Length of leaves per plant was found Maximum (15.88, 18.43, 25.14 cm at 30,45,60 DAS) in T6 (ZnSO₄ 400 ppm+ MnSO₄ 400 ppm/ L) and minimum was found (10.54, 13.42, 21.11 cm at 30,45,60 DAS) in T7 (control). Figure.4 Effects of Zinc and Manganese on Width of leaves (cm) of Turnip. The Width of leaves per plant was found Maximum (6.52, 8.42, 13.73 cm at 30,45,60 DAS) in T6 (ZnSO₄ 400 ppm+ MnSO₄ 400 ppm/ L) and minimum was found (4.80, 6.06, 9.09 cm at 30,45,60 DAS) in T7 (control). There was significant effect of zinc and manganese (Zn, Mn and their combination) on plant height and number of leaves per plant. Similarly Sarkar *et al.* (2018) [1] reported that there was significant effect of zinc and manganese on potato plant height, germination percentage and number of leaves per plant. With conformity with the present finding Magdi and Mousa (2009) also reported that there was significant effect of zinc and manganese on plant height. This may be due to decrease of auxin concentration in potato plant due to Zn (Puzina, 2004) [6]. This result shows that there is less effect of zinc and manganese on vegetative parameters of potato plants. Banerjee *et al.* (2016) [9] reported that zinc application did not significantly influence the germination percent in potato. Number of leaves per shoot and number of compound leaves per plant increased due to foliar application of Zn, Mn and their combination. Manna *et al.* (2014) [4] also

reported that application of zinc and manganese significantly increased the no. of leaves of onion. The increase in number of leaves may be due to the increase in cytokinin content of plant which leads to the development of new leaves. Puzina (2004) [6] showed that Zinc-sulfate treatment in potato shifted the hormonal balance toward a substantial increase in the cytokinin content and the cytokinin/ABA ratio, as well as a decrease in the IAA/cytokinin ratio.

Conclusion

The study demonstrated that combining micronutrients like Zinc Sulphate (ZnSO₄) 400 ppm + Manganese sulphate (MnSO₄) 400 ppm/L enhanced the vegetative growth which resulted maximum plant height, number of leaves, length of leaves, width of leaves, while the least growth was observed in Control. The superior performance of high ppm solutions is attributed to more growth and high yield. Thus, Zinc Sulphate (ZnSO₄) + Manganese sulphate (MnSO₄) together in high quantities is recommended as the most effective practice for better results for Turnip.

References

1. Banerjee H, Sarkar S, Deb P, Dutta SK, Ray K, Rana L, *et al.* Impact of zinc fertilization on potato (*Solanum tuberosum* L.) yield, zinc use efficiency, quality and economics in Entisol of West Bengal. *J Indian Soc Soil Sci.* 2016;64(2):176-82.
2. Chaudhari VJ, Patel NK, Tandel BM, Vibhuti C. Effect of foliar spray of micronutrients on growth and yield of cauliflower (*Brassica oleracea* L. var. botrytis). *Int J Chem Stud.* 2017;5:1133-5.
3. Magdi AA, Mousa. Effect of zinc plus manganese foliar application on potato performance and quality. *Assiut J Agric Sci.* 2009;40(1):17-35.
4. Manna D, Maity TK, Ghoshal A. Influence of foliar application of boron and zinc on growth, yield and bulb quality of onion (*Allium cepa* L.). *J Crop Weed.* 2014;10(1):53-5.
5. Mekki BB. Root yield and quality of sugar beet (*Beta vulgaris* L.) in response to foliar application with urea, zinc and management in newly reclaimed sandy soil. *J Agric Environ Sci.* 2014;14(9):800-6.

6. Puzina TI. Effect of zinc sulfate and boric acid on the hormonal status of potato plants in relation to tuberization. *Russ J Plant Physiol.* 2004;51(2):209-15.
7. Saad M, Howladar, Osman AS, Rady MM, Hassan S, Al-Zahrani. Magnesium foliar application and Phosphorien soil inoculation positively affect *Pisum sativum* L. plants grown on sandy calcareous soil. *Int J Agric Biosyst Eng.* 2014;8(5):436-40.
8. Samad A, Khalifa RKM, Lashine ZA, Shafeek MR. Influence of urea fertilization and foliar application of some micronutrients on growth, yield and bulb quality of onion. *Aust J Basic Appl Sci.* 2011;5:96-103.
9. Sarkar S, Banerjee H, Chakraborty I, Sau S, Ray K, Ghosh D, *et al.* Assessment of growth, yield, tuber quality and profitability of potato upon boron fertilization. *J Environ Biol.* 2018;39:1-8.