Asian Research Journal of Agriculture

Volume 17, Issue 4, Page 921-926, 2024; Article no.ARJA.126915
ISSN: 2456-561X

Effect of Different Micronutrients on the Growth of Turmeric (*Curcuma longa* L.) cv. Salem

Pranil A. Gawit [a++*], P. C. Mali [b], R. C. Gajbhiye [c], N. V. Dalvi [c] and N. H. Khobragade [d]

[a] Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.
[b] College of Horticulture, Mulde, Sindhudurg, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.
[c] College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra,India.
[d] Department of Soil Science & Agriculture Chemistry, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/arja/2024/v17i4603

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/126915

Original Research Article

Received: 18/09/2024
Accepted: 21/11/2024
Published: 26/11/2024

ABSTRACT

The present investigation entitled "Performance of different micronutrients on the growth and yield of turmeric (*Curcuma longa* L.) cv. Salem produced by pro tray method." was conducted during the year 2023-2024 at AICRP, on Spices, Asond Block, Central Experimental Station, Wakavali, Dapoli,

[++] M. Sc. Scholar;
**Corresponding author: E-mail: pranilgavit32@gmail.com;*

Cite as: *Gawit, Pranil A., P. C. Mali, R. C. Gajbhiye, N. V. Dalvi, and N. H. Khobragade. 2024. "Effect of Different Micronutrients on the Growth of Turmeric (Curcuma Longa L.) Cv. Salem". Asian Research Journal of Agriculture 17 (4):921-26. https://doi.org/10.9734/arja/2024/v17i4603.*

Dist- Ratnagiri (M.S.), India. The experiment was conducted in randomized block design with nine treatment namely T_1: Control (RDF: 200:50:150 kg NPK ha-1), T_2: Foliar spray of ZnSO4@ 0.5%, T_3: Foliar spray ZnSO4 @ 0.75%, T_4: Foliar spray of Borax @ 0.2%, T_5: Foliar spray of Borax @ 0.3%, T_6: Foliar spray MnSO4 @ 0.25%, T_7: Foliar spray of MnSO4 @ 0.5%, T_8: Foliar spray of FeSO4 @ 0.3%, T_9: Foliar spray of FeSO4@ 0.4% and each treatment was replicated three times. The observations were recorded at 30 days interval at 60, 90, 120 and 150 days after transplanting. The results obtained from the present experiment revealed that application of RDF + Foliar spray of ZnSO4 @ 0.75 % showed overall best results in growth characters at 150 Days after transplanting like Plant height (81.97 cm), leaf length (56.11 cm), leaf width (16.56cm), number of leaves (15.56) and number of tillers (3.5). Thus, from the results obtained, it can be concluded that application of RDF + Foliar Spray of ZnSO4 @ 0.75 % was the most effective for maximizing the growth parameters of turmeric (*Curcuma longa* L.) under Konkan agro- climatic conditions.

Keywords: Turmeric; growth; boron; zinc.

1. INTRODUCTION

Turmeric (*Curcuma longa* L). is recognized as the “Golden spice” and also as the “Spice of life.” It is the most important spice in India from time immemorial. It has a strong relation with sociocultural life of people in India. The orange-yellow rhizomes of turmeric was considered as “Herb of sun” by people of Vedic period. Turmeric has a vast history of around 6000 years for its medicinal used and socio-religious practices. (Ravindran) [1]. Turmeric is a herbaceous perennial plant with a thick underground rhizome which gives rise to primary and secondary rhizomes called fingers. For germination temperature should be 30-35°C and for rhizome initiation 20-25°C. It can be grown at 1500 m above mean sea level. A well distributed rainfall of 1500-2250 mm per annum is ideal. Turmeric is grown in different types of soil from sandy loam, red soils to clay loam soil, light black soil, but it thrives best in well drained sandy loam humus rich soil with pH range of 4.5 to 7.5. The crop cannot stand water logging or alkalinity. India is the largest producer and exporter of turmeric, accounting for approximately 80 percent of the world’s total production followed by Bangladesh, Myanmar, Pakistan, Thailand and China. Turmeric ranks 3rd in the total export of spices from India after chilli and cumin. In the year 2021-22, India exported 1, 52,758 tonnes of turmeric worth of 153,442.05 lakhs. (Anonymous) [2]. In India, Maharashtra (278000 tones), Telangana (250000 tones), Karnataka (130074 tones), Tamil Nadu (100000 tones) and Andhra Pradesh (73678 tones) are the major turmeric producing states, in which Maharashtra alone contributes 28 per cent share of total production followed by Telangana. (Anonymous) [3].

Turmeric is highly responsive to chemical fertilizers. Also the use of the micronutrients fertilizers are mostly liable to reduce disease incidence and enhance durability of the post-harvest life of ginger and turmeric (Halder) [4]. The application of various micronutrients plays a pivotal role in the growth and yield of turmeric. Micronutrients such as zinc, boron, manganese and iron are essential for optimizing the physiological functions of turmeric plants, influencing key growth parameters and enhancing overall productivity by keeping this view present investigation was undertaken.

2. MATERIALS AND METHODS

The research was conducted at AICRP on Spices, Asond Block, Central Experimental Stations, Wakavali. College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India during the year 2023-24. The experimental site was located under high rainfall area with annual rainfall of 3000-4000 mm and having red, laterite alluvial soil. One month old turmeric seedlings were used for planting and are planted at a distance of 30 cm between plants and 25 cm between rows. The experiment was laid out in Randomized Block Design (RBD) with three replications and nine treatments viz. T_1 (Control (RDF: 200:50:150 kg NPK ha-1), T_2 (Foliar spray of Zinc (as $ZnSO_4$) 0.5%), T_3 (Foliar spray of Zinc (as $ZnSO_4$) 0.75%), T_4 (Foliar spray of Boron (as Borax) 0.2%), T_5 (Foliar spray of Boron (as Borax) 0.3%), T_6 (Foliar spray of Manganese (as $MnSO_4$) 0.25%), T_7 (Foliar spray of Manganese (as $MnSO_4$) 0.5%), T_8 (Foliar spray of Iron (as $FeSO_4$) 0.3%), T_9 (Foliar spray of Iron (as $FeSO_4$) 0.4%). Micronutrients sprays were taken at 60, 90 and 120 days after transplanting. Ten plants were randomly selected from each

treatment for taking observations. Observations for yield and yield attributing characters were recorded in the last week of March and collected data were statistically analysed by the methods suggested by Panse and Sukhatme [5].

3. RESULTS AND DISCUSSION

3.1 Plant Height

Considerable variation was observed in the plant height of turmeric under different foliar application of micronutrients presented in Table 1. The application of RDF (200:50:150 kg/ha) combined with various micronutrient foliar sprays significantly impacted plant height at 150 days after transplanting (DAT). The maximum plant height of 81.97 cm was recorded in the treatment T_3 with RDF + ZnSO4 (0.75%) foliar spray, while the minimum height of 60.21 cm was observed in the control treatment T_1 with only RDF. The overall mean plant height across treatments was 71.39 cm, indicating a significant influence of micronutrient foliar application on the growth of turmeric plants. Similar results were reported by Singh (2014) in turmeric with foliar application of micronutrients and recorded the maximum number of leaves (11.99) as compared to other treatments. Hnamte et al. [6] reported that combine application of Boron @ 0.2% and Zinc @ 0.5% thrice gave the maximum number of leaves over other treatments in turmeric. Das et al. [7] observed that, foliar application of 150 ppm boron + 0.4 % zinc sulphate recorded the highest plant height (67.66 cm) in brinjal.

3.2 Leaf length

The leaf length in turmeric plants at 150 days after transplanting (DAT) was notably affected by different foliar applications of micronutrients and the data regarding leaf length was presented in Table 2. The largest leaf length measured was 56.11 cm with the treatment T3 of RDF + Foliar spray of ZnSO4 (0.75%), whereas the lowest was 45.58 cm in the control treatment T1 with RDF (200:50:150 kg/ha). The average leaf width across all treatments was 50.14 cm. Patel et al. [8] observed that combine application of FeSO4 0.5% + ZnSO4 0.5% + Boron 0.5% in turmeric at 60, 90 and 120 after planting gave the highest leaf length of 56.93, 62.40 and 84.60 cm, respectively.

3.3 Leaf Width

Leaf width at 150 days after transplanting (DAT) was significantly influenced by the foliar application of micronutrients (Table 3). The minimum leaf width of 13.42 cm was recorded with the control treatment (T1), which consisted of RDF (200:50:150 kg/ha) alone. In contrast, the maximum leaf width of 16.56 cm was observed in treatment T3 with the foliar application of ZnSO4 at 0.75% in combination with RDF. The results highlight the substantial impact of micronutrient foliar sprays on leaf width, emphasizing the effectiveness of ZnSO4 at higher concentrations. Similar results observed by Hnamte et al. [6] they reported that the combine application of Boron @ 0.2% and Zinc @ 0.5% thrice in turmeric gave maximum leaf width over other treatments. Agnihotri *et al* [9], reported that the, highest leaf width was recorded with the foliar application of 0.50 % Zn + 0.2% boron solution in cauliflower.

3.4 Number of Leaves Per Plant

Various micronutrients treatments had a notable effect on the number of leaves per turmeric plant at 150 days after transplanting (DAT). The treatment T_5 with RDF combined with a foliar spray of borax at 0.3% produced the highest number of leaves per plant (16.88) which was at par with the treatment T3 foliar application of $ZnSO_4$ at 0.75%, whereas the control treatment T_1 (RDF 200:50:150 kg/ha) resulted in the lowest leaves per plant (13.42). These results highlight the significant role of micronutrient treatments in enhancing leaf development in turmeric plants. Hnamte et al. [6] reported that combine application of Boron @ 0.2% and Zinc @ 0.5% thrice gave the maximum number of leaves over other treatments in turmeric.

3.5 Number of Tillers Per Plant

The foliar application of different micronutrients had a significant impact on the number of tillers in turmeric plants at 150 days after transplanting (DAT). The treatment T_5 with RDF combined with a foliar spray of Borax (0.3%) produced the highest number of tillers per plant (3.70) which was at par with the treatment T_3 foliar application of $ZnSO_4$ at 0.75%. Conversely, the control T_1, which only received the recommended dose of fertilizers (RDF), showed the lowest tiller count at 2.83 per plant. Boron and zinc are essential micronutrients that significantly contribute to plant growth and tiller production in turmeric.

Boron plays a crucial role in strengthening cell walls, regulating hormonal balance, particularly auxins, and enhancing the uptake of other vital

Table 1. Effect of micronutrients on height of plant

Plant height (cm)					
	Treatment	**60 DAT**	**90 DAT**	**120 DAT**	**150 DAT**
T_1	Control: RDF (200:50:150 kg/ha)	27.67	39.79	50.64	60.21
T_2	RDF + Foliar spray of $ZnSO_4$ (0.5%)	38.33	47.06	58.56	73.05
T_3	RDF + Foliar spray of $ZnSO_4$ (0.75%)	42.61	56.48	67.25	81.97
T_4	RDF + Foliar spray of Borax (0.2%)	39.33	48.66	60.64	75.72
T_5	RDF + Foliar spray of Borax (0.3%)	41	56.09	66.13	81.07
T_6	RDF + Foliar spray of $MnSO_4$ (0.25%)	34.33	42.19	54.36	67.24
T_7	RDF + Foliar spray of $MnSO_4$ (0.50%)	37.33	46.08	57.66	70.79
T_8	RDF + Foliar spray of $FeSO_4$ (0.3%)	36.67	43.86	55.58	68.77
T_9	RDF + Foliar spray of $FeSO_4$ (0.4%)	34.00	41.33	53.65	63.73
	Mean	36.81	46.84	58.28	71.39
	S. Em. (±)	2.8	1.807	1.517	3.817
	C.D. at 5%	-	5.418	4.547	11.443
	Result	N. S.	SIG	SIG	SIG

Table 2. Effect of micronutrients on leaf length

Leaf length (cm)					
	Treatment	**60 DAT**	**90 DAT**	**120 DAT**	**150 DAT**
T_1	Control: RDF (200:50:150 kg/ha)	19.12	21.66	37.56	45.58
T_2	RDF + Foliar spray of $ZnSO_4$ (0.5%)	23.29	27.66	43.53	51.07
T_3	RDF + Foliar spray of $ZnSO_4$ (0.75%)	25.43	31.80	47.69	56.11
T_4	RDF + Foliar spray of Borax (0.2%)	23.53	28.04	43.83	51.45
T_5	RDF + Foliar spray of Borax (0.3%)	23.69	31.79	47.56	54.68
T_6	RDF + Foliar spray of $MnSO_4$ (0.25%)	21.78	24.95	40.83	47.98
T_7	RDF + Foliar spray of $MnSO_4$ (0.50%)	23.28	25.82	41.55	49.17
T_8	RDF + Foliar spray of $FeSO_4$ (0.3%)	22.13	25.04	40.91	48.13
T_9	RDF + Foliar spray of $FeSO_4$ (0.4%)	20.25	24.08	37.84	47.05
	Mean	22.50	26.76	42.37	50.14
	S. Em. (±)	2.50	1.60	1.56	1.62
	C.D. at 5%	-	4.81	4.67	4.85
	Result	N. S.	SIG	SIG	SIG

Table 3. Effect of micronutrients on leaf width

Leaf width (cm)					
	Treatment	**60 DAT**	**90 DAT**	**120 DAT**	**150 DAT**
T_1	Control: RDF (200:50:150 kg/ha)	5.0	7.76	10.72	13.42
T_2	RDF + Foliar spray of $ZnSO_4$ (0.5%)	6.4	9.29	12.00	14.63
T_3	RDF + Foliar spray of $ZnSO_4$ (0.75%)	6.9	11.28	13.79	16.56
T_4	RDF + Foliar spray of Borax (0.2%)	6.8	9.65	12.57	15.37
T_5	RDF + Foliar spray of Borax (0.3%)	6.9	9.97	13.19	15.88
T_6	RDF + Foliar spray of $MnSO_4$ (0.25%)	6.1	8.20	11.08	13.90
T_7	RDF + Foliar spray of $MnSO_4$ (0.50%)	5.8	8.98	11.87	14.52
T_8	RDF + Foliar spray of $FeSO_4$ (0.3%)	6.2	8.58	11.55	14.29
T_9	RDF + Foliar spray of $FeSO_4$ (0.4%)	5.7	8.12	10.95	13.77
	Mean	6.2	9.09	11.97	14.71
	S. Em. (±)	0.38	0.52	0.59	0.62
	C.D. at 5%	-	1.56	1.78	1.86
	Result	N.S	SIG	SIG	SIG

Table 4. Effect of micronutrients on number of leaves per plant

Number of leaves					
	Treatment	**60 DAT**	**90 DAT**	**120 DAT**	**150 DAT**
T_1	Control: RDF (200:50:150 kg/ha)	4.53	7.76	10.72	13.42
T_2	RDF + Foliar spray of $ZnSO_4$ (0.5%)	5.27	9.29	12.00	14.63
T_3	RDF + Foliar spray of $ZnSO_4$ (0.75%)	5.47	9.97	13.19	15.56
T_4	RDF + Foliar spray of Borax (0.2%)	5.30	9.65	12.57	15.37
T_5	RDF + Foliar spray of Borax (0.3%)	5.60	11.28	13.79	16.88
T_6	RDF + Foliar spray of $MnSO_4$ (0.25%)	5.17	8.20	11.08	13.90
T_7	RDF + Foliar spray of $MnSO_4$ (0.50%)	5.27	8.98	11.87	14.52
T_8	RDF + Foliar spray of $FeSO_4$ (0.3%)	5.20	8.58	11.55	14.29
T_9	RDF + Foliar spray of $FeSO_4$ (0.4%)	5	8.12	10.95	13.77
	Mean	5.21	9.09	11.97	14.71
	S. Em. (±)	0.24	0.52	0.59	0.62
	C.D. at 5%	-	1.56	1.78	1.86
	Result	N.S.	SIG	SIG	SIG

Table 5. Effect of micronutrients on number of tillers per plant

Number of tillers per plant					
	Treatment	**60 DAT**	**90 DAT**	**120 DAT**	**150 DAT**
T_1	Control: RDF (200:50:150 kg/ha)	0.00	0.90	1.47	2.83
T_2	RDF + Foliar spray of $ZnSO_4$ (0.5%)	0.10	1.47	2.47	3.33
T_3	RDF + Foliar spray of $ZnSO_4$ (0.75%)	0.10	1.63	2.80	3.50
T_4	RDF + Foliar spray of Borax (0.2%)	0.10	1.57	2.67	3.40
T_5	RDF + Foliar spray of Borax (0.3%)	0.13	1.73	2.90	3.70
T_6	RDF + Foliar spray of $MnSO_4$ (0.25%)	0.07	1.13	1.90	3.00
T_7	RDF + Foliar spray of $MnSO_4$ (0.50%)	0.07	1.30	2.20	3.20
T_8	RDF + Foliar spray of $FeSO_4$ (0.3%)	0.07	1.23	2.03	3.13
T_9	RDF + Foliar spray of $FeSO_4$ (0.4%)	0.03	1.07	1.60	2.93
	Mean	0.07	1.34	2.23	3.23
	S. Em. (±)	0.03	0.07	0.05	0.07
	C.D. at 5%	-	0.200	0.144	0.213
	Result	N.S.	SIG	SIG	SIG

nutrients, all of which support the development of new tillers. Meanwhile, zinc acts as a cofactor for enzymes involved in protein synthesis and energy production, promotes the synthesis of auxins and supports chlorophyll production, ensuring efficient photosynthesis. Together, these micronutrients optimize plant structure, metabolism and energy availability, leading to increased tiller production in turmeric. Singh [10] reported that, two foliar applications of micro-nutrients @ 0.5% at 60 and 90 days after sowing gave the highest number of tillers (4.62) in turmeric.

4 .CONCLUSION

The research findings showed that foliar application of micronutrients (Zinc, boron, manganese and iron) had significant impact of turmeric plant growth over the application of RDF alone. Application of RDF alone (T_1) notably recorded the minimum number of leaves, number of tillers, plant height, leaf length and leaf width. Whereas application of zinc 0.75% through zinc sulphate (T_3) recorded overall higher growth characters in turmeric during different crop growth stages.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOYT, etc.) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ravindran PN. Turmeric: The golden spice of life. CRC Press, Taylor & Francis

Group, 6000 Broken Sound Parkway NW, Suite-300. 2007;1–14.

2. Anonymous. 2022. Crop outlook report of Andhra Pradesh: Turmeric. Acharya N. G. Ranga Agriculture University. Available:https://angrau.ac.in/downloads/AMIC/OutlookReports/2022/5Turmeric%20Outlook% 20Report%20-%20January%20to%20December%202022
3. Anonymous. Establishment of National Turmeric Board. Press Information; 2023. Bureau. Available:https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1964083
4. Halder NK, Shill NC, Siddiky MA, Sarkar J, Gomes R. Response of turmeric to zinc and boron fertilization. Journal of Biological Science. 2007;7(1):182- 187.
5. Panse VG, Sukatme PV. Statistical methods for Agricultural Workers. ICAR-New Delhi; 1995.
6. Hnamte V, Chatterjee R, Lungmuana, Patra PK. Influence of Boron and Zinc nutrition on growth, yield and quality of turmeric (*Curcuma longa* L.) in Gangetic alluvial soil of West Bengal. Journal of Crop and Weed. 2018;14(1):72-77.
7. Das SK, Sikder S, Sarkar RM, Basfore S. Effect of foliar application of boron and zinc on growth, Yield and quality of local brinjal (*Solanum melongena* L.) Genotypes. Biological Forum- An International Journal. 2023;15(12): 221-226.
8. Patel DV, Bhalerao PP. Tandel BM. Effect of micronutrient application on growth, yield and quality of turmeric (*Curcuma longa* L.) cv. GNT-2. Int. J. Agri. Sci. 2022;14(1): 11043-11045.
9. Agnihotri A, Kumar B. Vishwanath Kumar T, Karan D. Effect of foliar application of zinc and boron on the growth and yield and Cauliflower (*Brassica oleracea* var. bortrytis L.). Annals of Plant and Soil Research. 2002;22(4):386-389.
10. Singh SP. Effect of micro-nutrients on growth, yield and economics of turmeric (*Curcuma longa*L.) *cv*. Rajendra Sonia. Asian J. Hort. 2014;9(1):169-173.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/126915