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Abstract

Nutrient Management, Nutrient Deficiency Symptoms and their corrective measures in Turmeric

[1]Bhuvaneswari.J., [2]S. Thenmozhi and [3]T. Sampathkumar
[1]Assistant Professor, Department of Agronomy, VOC AC& RI, Killikulam – 628252
[2]Associate Professor, ICAR-KVK, Ooty- 643 002
[3]Assistant Professor, Department of Agronomy, AC& RI, Madurai- 625104
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Turmeric, a plant belonging to the ginger family (Zingiberaceae), is native to Southeast Asia and is grown commercially in that particular region, predominantly in India. The rhizome, which is an underground stem, serves as both a culinary spice and traditional medicine. Turmeric was formerly employed in Ayurveda and other conventional Indian medical practices, as well as Eastern Asian medical practices such as traditional Chinese medicine. India, it was traditionally utilized for ailments related to the skin, upper respiratory tract, joints, and digestive system.

Today, turmeric is used as a dietary supplement for a variety of conditions, including arthritis, digestive disorders, respiratory infections, allergies, liver disease, depression, and many others. Turmeric is a spice and an important component of curry powder. The turmeric plant produces a bright yellow chemical called curcumin, and it is commonly attributed to the activities of turmeric due to curcuminoids. . Turmeric capsules are produced from the ground root, and usually include a blend of curcumin compounds. Turmeric is also utilized to create a paste for skincare purposes.

India stands as a top manufacturer and exporter of turmeric globally. States like Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Meghalaya, Maharashtra, and Assam are among the key regions that grow turmeric. Specifically, Andhra Pradesh alone covers 35% of the total area and is responsible for 47.01% of turmeric production.

Climate and soil

Turmeric can grow in a variety of tropical conditions from sea level to 1500 m above the sea level, at a temperature range of 20 - 35°C with an annual rainfall of 1500 mm or more, under rainfed or irrigated conditions. Although it may be cultivated in a variety of soil types, turmeric grows best on sandy or clay loam soils that have good organic status and a pH range of 4.5 to 7.5.

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Manures and manuring

Basal: The basal application for turmeric includes FYM (25 t ha^{-1}), neem or groundnut cake (200 kg ha^{-1}), 25:60:108 kg of NPK per ha; 30 kg of $FeSO_4$ and 15 kg of $ZnSO_4$, 10 kg in each of Azospirillum and Phosphobacteria per ha to be used right before planting.

Top dressing: 108 kg of N and K ha^{-1} applying at. 25: 30, 60, 90, 120, and 150 days after planting.

Application of micronutrients: During the rhizome growth stage, apply 375 g of urea, ferrous sulfate, zinc sulfate, and borax in 250 lit of water per hectare. Apply twice with a 25-day gap. The aforementioned micronutrients are dissolved in a superphosphate slurry (15 kg of superphosphate is dissolved in 25 lit of water, which is then stored overnight, resulting in a 250 lit supernatant solution).

Fertigation:

Fertigation involves the suggested dose of 150:60:108 kg of NPK ha^{-1} and it is applied at an interval of three days throughout the cropping period. The basal dose of phosphorus is delivered at 75% of the prescribed dose. Fertigation uses water-soluble fertilizers such as urea, 19:19:19, Multi K (13:0:45), and Mono ammonium phosphate (12:61:0).

Fertigation schedule for turmeric

Crop Stage	Duration (in days)	Nutrients requirement (%)			Quantity applied (kg ha^{-1})	
Planting to establishment stage	15	10	20	10	19:19:19 Multi K Urea	15.78 17.33 21.20
Growth phase	60	40	30	20	19:19:19 Multi K Urea	9.83 96.00 100.57
Rhizome emergence stage	60	30	30	30	19:19:19 Multi K Urea	4.91 71.28 76.29
Rhizome maturation stage	135	20	20	40	19:19:19 Multi K Urea	15.78 40.42 47.06
Total Duration	**270**	**100**	**100**	**100**		

DEFICIENCY SYMPTOMS

Nitrogen

Deficiency Symptoms

- The symptoms can be first observed in the more mature leaves.
- The older leaves become light green or yellow-green
- Gradual appearance of reddish tints at the edges of the leaves which expands to the central vein or midrib.
- Overall growth is significantly diminished. Size of the leaves is small. Deficiency leads to a drop in rhizome output.

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Correction Measure

- Application of 140 kg N ha^{-1} in urea form in five split doses *viz.,* at planting 30,60,90 and 120 DAP along with 60 Kg of P_2O_5 and 60 Kg K_2O or foliar spray of DAP 2% or 1% urea two times at weekly interval.

Phosphorus

Deficiency Symptoms

- The plant shows reduced growth, foliage may turn brown or purple. Certain plants have slender stems with fewer lateral fractures.

Correction Measure

- 6 kg of superphosphate is added to 100 liters of water that has been prepared the day before, and the clear filtrate is collected the following day. Add 100 g of borax, 150 g of $MgSO_4$, 150 g of $FeSO_4$, and 150 g of urea to this. Applying the mixture every 15 days until the symptoms diminishes.

Potassium

Deficiency Symptoms

- The plant shows reduced growth with shortened internodes, marginal scorching of leaves. brown leaf margins, necrotic patches within the leaf, less lateral splits, and an easy tendency to wilt are other symptoms.

Correction Measure

- K application at a rate of 90 kg ha^{-1} applied in four splits (basal, 60, 90, and 120 DAP) or 1% K_2SO_4 sprayed on leaves every two weeks.

Magnesium

Deficiency Symptoms

- Symptoms first appear on the older leaves. Older leaves may fall off, or they develop a triangular arrowhead at the leaf base, near the stalk.
- The plants may grow slowly. Older leaves turn yellow especially in between veins (interveinal chlorosis)

Correction Measure

- Apply a foliar spray of magnesium sulphate at a concentration of 0.5% (5g $MgSO_4$ dissolved in 1 lit of water) to foliage every 15 days till the disappearance of symptoms.

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Sulphur

Deficiency Symptoms

- The plant shows stunted growth, The plant grows slowly, its leaves eventually develop a pale-yellow color, and chlorosis sets in.

Correction Measure

- Apply foliar spray of magnesium sulphate solution (5g MgSO4 diluted in 1 lit of water) plus 10g urea to foliage every 15 days till the disappearance of symptoms.

Iron

Deficiency Symptoms

- Plants' immature leaves develop interveinal chlorosis, which spreads quickly across the entire leaf. In extreme circumstances, the leaves turn pure white.

Correction Measure

- Apply 30 kg ha^{-1} of $FeSO_4$ to the soil, then 2.5 kg ha^{-1} of $FeSO_4$ via foliar spray in the third, fourth, and fifth months.

Manganese

Deficiency Symptoms

- Symptoms occur on fresh leaves. The veins are variegated and range from light green to golden green.

Correction Measure

- Spraying with Manganese Sulphate solution 0.5% twice per week.

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