

Response of turmeric (*Curcuma longa* L.) to application of Polyhalite: A novel balanced slow releasing fertilizer

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Abstract

Turmeric (*Curcuma longa* L.) is an important spice crop cultivated for its underground rhizome. In Karnataka, commercial cultivation is concentrated in southern districts like Mysore, Chamarajanagar. Western ghats area is prominently cultivating ginger. Due to excessive biotic and abiotic stress observed in ginger an alternate crop needs to be evaluated here. Major challenge noticed in this area is high intense rainfall during July & August month. This high rainfall not only threat from the point of rot diseases but also has high nutrient leaching losses also. Hence slow release fertilizer with all required plant nutrient elements is need of the hour in this region for any crop. Polyhalite, a mineral that contains potassium, magnesium, calcium, and sulfate, has received increasing recognition in recent years as a valuable asset in sustainable agriculture and can serve as a viable alternative to conventional fertilizers. This multi-nutrient fertilizer, mainly obtained from evaporite deposits is distinct combination of nutrients like 14% K₂O, 19% S, and 6% MgO, along with 17% CaO. Keeping these points in view, an observational trial was conducted at Spices Boards' regional research station - ICRI Sakleshpur, Karnataka during 2024-25. The experiment was conducted under irrigated condition. The soil of experimental plot was sandy loam in texture, pH 5.9 organic carbon content 1.3%, phosphorus 18 kg/ha, potassium 338 kg/ha. The trail was laid out in Randomized complete block design (RCBD) with four replications and five treatments. turmeric cultivar IISR Prathibha was used in the trial. T₁: RDF (100:50:50 kg ha⁻¹), T₂: RDF + 3 foliar spray of IISR Turmeric special, T₃: RDF + Polyhalite @ 100kg /ha in single split – 60 DAP, T₄: RDF + Polyhalite @ 250kg /ha in two splits – 60 & 90 DAP and T₅: RDF + Polyhalite @ 500kg /ha in three splits – 60, 90 & 120 DAP. The plot size of 3m x 1m was maintained. The spacing followed was 45 cm x 20 cm. Application of polyhalite @ 500kg/ha to turmeric at critical stages of crop nutrient requirement has helped in attaining higher number of primary rhizomes (9.2). Significantly higher mother (72.9.4g), primary (308.2 g) and secondary (75.6 g) fresh rhizome weight was recorded in turmeric where polyhalite was applied @500kg/ha. Application of polyhalite at 500kg/ha in two splits along with RDF for turmeric has helped to achieve higher dry rhizome yield as well as recovery percentage (7.14 tonnes/ha & 22.02%) higher net return (Rs 2,49,800) as well as BC ratio (2.00)

Keywords: Turmeric, rhizome, polyhalite, nutrient and yield

Introduction

Turmeric (*Curcuma longa* L.), a valuable spice crop and been cultivated since ancient times in India for its aromatic underground rhizome. In Karnataka, commercial cultivation is concentrated in southern districts like Chamaraja Nagara and Mysore. Western ghats area is prominently cultivating ginger. Due to excessive biotic and abiotic stress observed in ginger an alternate crop needs to be evaluated here. Turmeric will be ideal choice in this area dur to wide spread rainfall and hardy nature of turmeric. Generally, these areas are having acidic soils with high organic carbon in soil. Major challenge noticed here is high intense rainfall during July & August month. This high rainfall not only threat from the point of rot diseases but also has high nutrient leaching losses also. Hence slow release fertilizer with all required plant nutrient elements is need of the hour in this region for any crop. Polyhalite, a mineral that contains potassium, magnesium, calcium, and sulfate, has received increasing recognition in recent years as a valuable asset in sustainable agriculture and can serve as a viable alternative to conventional fertilizers. This multi-nutrient fertilizer, mainly obtained from evaporite deposits, serves as an important resource for enhancing soil quality and boosting crop production. Polyhalite's distinct combination of

nutrients set it apart from standard fertilizers. It consists of approximately 14% K₂O, 19% S, and 6% MgO, along with 17% CaO. The availability of these nutrients (potassium, sulphur, magnesium and calcium) is vital for plant health, supporting photosynthesis, nutrient absorption, and other essential physiological processes. Recent research indicates that polyhalite can be specifically beneficial for crops with higher potassium demands, such as spices and plantation crops. Its slow release characteristic ensures a steady distribution of nutrients, reducing the likelihood of leaching and related environmental issues. Additionally, because it has a lower salt index than typical potassium fertilizers, polyhalite can enhance soil conditions and also aid in alleviating osmotic stress on plants (Bhatt *et al* 2021) ^[1]. Keeping these points in view, an observational trial was conducted at Spices Boards' regional research station of ICRI Sakleshpur, Karnataka during 2024-25. Main objective of the trial is to record the response of turmeric to polyhalite application in addition to RDF.

Material and Methods

An observational field trial was conducted at Spices Board, Indian Cardamom Research Institutes' Regional Research Station, Sakleshpur, Karnataka, India. The study reported

here was initiated in April 2024 (2024-2025). The study area falls under hilly zone, (IX agroclimatic zone of Karnataka). The experiment was conducted under irrigated condition. The soil of experimental plot was sandy loam in texture, pH 5.9 organic carbon content 1.3%, phosphorus 18 kg/ha, potassium 338 kg/ha. The trail was laid out in Randomized complete block design (RCBD) with four replications and five treatments. Turmeric cultivar IISR Prathibha was used in the trial. The treatment details as follows

- T₁: RDF (100:50:50 kg ha⁻¹)
- T₂: RDF + 3 foliar spray of IISR Turmeric special
- T₃: RDF + Polyhalite @ 100kg /ha in single split – 60 DAP.
- T₄: RDF + Polyhalite @ 250kg /ha in two splits – 60 & 90 DAP.
- T₅: RDF + Polyhalite @ 500kg /ha in three splits – 60, 90 & 120 DAP.

The plot size of 3m x 1m was maintained. The spacing followed was 45 cm x 20 cm. All agronomic practices viz., irrigation, manuring, fertilizer application, weeding, plant protection was done according to the IISR Kozhikode guidelines Observations on growth attributes were recorded

at 150 DAP. Obtained data was statistically analysed following statistical procedures outlined by Gomez and Gomez.1984 [2].

Results and Discussion: Varied approaches of nutrient management in turmeric showed non-significant response for plant height and number of tillers/plants in turmeric. On the contrary significantly higher rhizome weight per plant was recorded in treatment receiving RDF along with 250 kg & 500 kg of Polyhalite applied in two / three splits as compared to rest of the treatments. Data pertaining to the yield attributing characters like, fresh weight of mother, primary and secondary rhizomes, fresh rhizome yield per plant and fresh rhizome yield per hectare varied significantly due to various nutrient management practices. Application of polyhalite @ 500kg/ha to turmeric at critical stages of crop nutrient requirement has helped in attaining higher number of primary rhizomes (9.2). Significantly higher mother (72.9.4g), primary (308.2 g) and secondary (75.6 g) fresh rhizome weight was recorded in turmeric where polyhalite was applied @500kg/ha. Hence per plant fresh rhizome weight was significantly higher in T₅ where polyhalite was applied @ 500kg/ha.

Table 1: Effect of polyhalite fertilizer on growth and yield of turmeric

Treatments	Plant height (cm)	Number of tillers	Mother rhizome weight (g/clump)	Primary rhizome weight (g/clump)	Secondary rhizome weight (g/clump)	Fresh rhizome weight/clump (g/clump)
T ₁ : RDF (100:50:50 kg ha ⁻¹)	106.6	6.5	58.4	258.9	42.0	359.3
T ₂ : RDF + 3 foliar spray of IISR Turmeric special	109.0	8.2	60.1	257.3	48.2	365.6
T ₃ : RDF + Polyhalite @ 100kg /ha in single split – 60 DAP.	102.6	8.5	59.6	269.6	59.4	388.6
T ₄ : RDF + Polyhalite @ 250kg /ha in two splits – 60 & 90 DAP.	108.0	7.8	72.3	292.4	62.6	427.3
T ₅ : RDF + Polyhalite @ 500kg /ha in three splits – 60, 90 & 120 DAP.	116.3	9.2	79.2	308.2	75.6	463.0
S.Em (±)	3.8	1.1	2.84	4.12	2.08	9.4
CD @5%	NS	NS	8.52	12.36	6.24	28.2

A yield advantage of 15-18% due to application of polyhalite @ 250 & 500 kgs/ha in turmeric can be directly attributed for better growth attribute like higher number of tillers /plants as well as higher dry recovery percentage. On the other side polyhalite being balanced slow releasing fertilizer has sustained progressive supply of required nutrient elements to ginger. Application of polyhalite can positively impact on soil quality by boosting cation exchange capacity (CEC), enhancing both the fertility and structure of the soil. This enhancement not only helps retain moisture but also fosters beneficial microbial activity, which is vital for nutrient cycling and the breakdown of organic matter. Furthermore, adding polyhalite to soil can assist in

reducing soil erosion. Its use can promote stronger root development in crops, leading to improved soil stability. Polyhalite consists of approximately 14% K₂O, 19% S, and 6% MgO, along with 17% CaO. Sustained availability of these nutrients is vital for spice crop like turmeric after 60 DAP to 150 DAP and in turn required to support photosynthesis, nutrient absorption, and other essential physiological processes. Recent research indicates that polyhalite can be specifically beneficial for crops with higher potassium demands, such as spices and plantation crops. Its slow release characteristic ensures a steady distribution of nutrients, reducing the likelihood of leaching and related environmental issues.

Table 2: Economics of turmeric under different nutrient management systems

Turmeric cultivars	Fresh rhizome weight/ha (tonnes/ha)	Dry recovery %	Dry rhizome weight/ha (tonnes/ha)	Cost of production (Rs)	Gross return (Rs)	Net return (Rs)	B C ratio
T ₁ : RDF (100:50:50 kg ha ⁻¹)	25.2	21.12	5.31	371700	1,61,700	1.77	371700
T ₂ : RDF + 3 foliar spray of	25.6	21.80	5.58	390600	1,75,600	1.82	390600

IISR Turmeric special							
T ₃ : RDF + Polyhalite @ 100kg /ha in single split – 60 DAP.	27.2	22.08	6.01	420700	2,05,700	1.96	420700
T ₄ : RDF + Polyhalite @ 250kg /ha in two splits – 60 & 90 DAP.	29.9	22.20	6.64	464800	2,34,800	2.02	464800
T ₅ : RDF + Polyhalite @ 500kg /ha in three splits – 60, 90 & 120 DAP.	32.4	22.02	7.14	499800	2,49,800	2.00	499800
S.Em (±)	1.4	0.24	0.14	-		-	-
CD @5%	4.2	NS	0.42	-		-	-

Selling price of cured rhizome Rs 70,000/- tonne

Additionally, because it has a lower salt index than typical potassium fertilizers, polyhalite can enhance soil conditions and also aid in alleviating osmotic stress on plants (Vipin Kumar *et al.*, 2023) [5]. Application of polyhalite at 500kg/ha in two splits along with RDF for turmeric has helped to achieve higher dry rhizome yield as well as recovery percentage (7.14 tonnes/ha & 22.02%) higher net return (Rs 2,49,800) as well as BC ratio (2.00) (table.2).

Conclusion

From the current study it can be concluded that, application of polyhalite fertilizer along with RDF in turmeric @500 kg/ha under high rainfall areas certainly helps in realising higher rhizome yield as well as financial benefits.

References

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