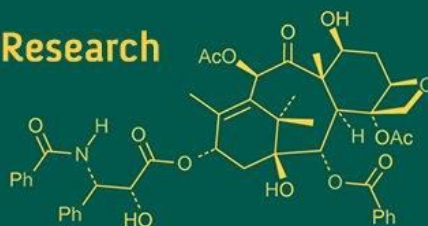


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Curcumin enrichment in turmeric (*Curcuma longa* L.) under organic cultivation using organic manures and biodynamic practices

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Abstract

A field experiment was conducted at Centre for Natural Resources Management, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District: Banaskantha (Gujarat) during the two consecutive *khari* seasons of the year 2023-24 and 2024-25 on "Effect of organic manures and biodynamics on growth, yield and quality of turmeric (*Curcuma longa* L.) under organic farming". The soil of the experimental plot was loamy sand in texture having pH (7.82) and EC (0.14 dS/m). Analysis showed that the experimental soil was low in organic carbon and available nitrogen, medium in phosphorus and high potassium status. There were twelve treatment combinations comprising three organic manures treatments *i.e.*, O₁: FYM @ 15 t/ha, O₂: Vermicompost @ 5 t/ha, O₃: *Ghanjivamrut* @ 5 t/ha and three biodynamics treatments *i.e.* B₁: Control, B₂: BD 500 (65 g/ha) soil spray at one day before planting, 30 and 60 DAP, B₃: BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP and B₄: B₂ + B₃ were tested in a RBD with factorial concept design with three replications. Effect of biodynamics with respect to curing percentage was failed to produce significant effect during the 2023-24 of study but found significant in 2024-25 and pooled results. Significantly higher curing percentage of 23.69 and 23.59% was recorded with treatment B₄ (BD 500) (65 g/ha) soil spray at one day before planting, 30 and 60 DAP + BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP), which was statistically at par with treatment B₂ (BD 500) (65 g/ha) soil spray at one day before planting, 30 and 60 DAP) in year 2024-25 and pooled, respectively whereas, treatment B₁ (control) recorded significantly lower curing percentage of 19.19 and 19.85% 2024-25 and pooled, respectively.

Keywords: Organic manures, Biodynamics, Turmeric, Curcumin, FYM, Vermicompost and *Ghanjivamrut*

Introduction

India is widely recognized as the "Land of Spices" being not only the largest producer but also the largest consumer and exporter of spices globally. Documented evidence reveals its widespread use in Indian households as a culinary spice, natural dye, beauty aid, and, most importantly, as a cornerstone of traditional medicine. Revered as the "golden spice" and often called the "spice of life," turmeric has been deeply embedded in the daily diet and healing practices of ancient India. Turmeric (*Curcuma longa* L.) belonging to the family *Zingiberaceae* is an important tropical rhizomatous spices crop, which originated from tropical South-East Asia with 21 basic chromosomes and somatic chromosome number $2n = 3x = 63$. Turmeric is a valuable and highly profitable crop of tropical regions and is referred to as "Indian Saffron" due to its color and use. The bright yellow color and pungent aromatic flavor of turmeric mainly due to the presence of coloring agent 'Curcumin' consisting of poly phenolic pigments like curcuminoids.

Organic farming techniques that promote beneficial microbial diversity offer sustainable solutions to several agricultural challenges. These methods improve soil fertility and productivity by supporting natural biological processes that align with environmental cycles. Biodynamic agriculture, rooted in ancient wisdom and formalized by Rudolf Steiner in the 1920s, is a holistic farming system that views the farm as a living, self-contained organism. Drawing inspiration from age-old agricultural traditions and cosmic principles, it integrates lunar and planetary rhythms, spiritual ecology, and natural cycles to guide sowing, harvesting, and soil renewal. Unlike conventional or even organic methods, biodynamic

farming seeks not just to sustain but to regenerate reviving the land’s subtle energies and fostering deep harmony between soil, plant, animal and cosmos.

A core component of biodynamic farming is the use of specific preparations, particularly BD 500 (horn manure) and BD 501 (horn silica), which act as natural bio stimulants to enhance plant growth, soil vitality and disease resistance. BD 500 is applied to the soil and works by stimulating microbial activity, enhancing nutrient cycling and promoting the formation of stable humus leading to improved soil structure and water retention. Conversely, BD 501 is used as a foliar spray to boost photosynthetic efficiency, optimize light assimilation, and aid in atmospheric nutrient absorption.

Materials and Methods

A field experiment was conducted at Centre for Natural Resources Management, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District: Banaskantha (Gujarat) during the two consecutive *kharif* seasons of the year 2023-24 and 2024-25 on “Effect of organic manures and biodynamics on growth, yield and quality of turmeric (*Curcuma longa* L.) under organic farming”. The soil of the experimental plot was loamy sand in texture having pH (7.82) and EC (0.14 dS/m). Analysis showed that the experimental soil was low in organic carbon and available nitrogen, medium in phosphorus and high

potassium status. There were twelve treatment combinations comprising three organic manures treatments *i.e.*, O₁: FYM @ 15 t/ha, O₂: Vermicompost @ 5 t/ha, O₃: *Ghanjivamrut* @ 5 t/ha and three biodynamics treatments *i.e.* B₁: Control, B₂: BD 500 (65 g/ha) soil spray at one day before planting, 30 and 60 DAP, B₃: BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP and B₄: B₂ + B₃ were tested in a RBD with factorial concept design with three replications.

A two years pooled study was conducted to evaluate the effects of various organic manures and biodynamics practices on turmeric cultivation under loamy sand soils of North Gujarat. The study revealed that the plant population at 45 days after planting and at harvest remained statistically uniform across all treatments. However, significantly higher plant height at 90, 120 days after planting and at harvest, along with superior yield parameters like the number of mother and finger rhizomes, fresh and dry yield of rhizomes were observed with *ghanjivamrut* @ 5 t/ha. These results were statistically at par with Vermicompost @ 5 t/ha.

Results and Discussion

Effect of organic manure on curing percentage

Looking the data narrated in Table 4.11, the effect of different organic manure treatment *viz.*, FYM @ 15 t/ha (O₁), vermicompost @ 5 t/ha (O₂) and *ghanjivamrut* @ 5 t/ha (O₃) were found to be non-significant for curing percentage during both the years and on pooled mean.

Table 1: Effect of organic manures and biodynamics on curing percentage

Treatments	Curing (%)		
	2023-24	2024-25	Pooled
Organic manures (O)			
O ₁ : FYM @ 15 t/ha	22.43	23.18	22.81
O ₂ : Vermicompost @ 5 t/ha	22.04	22.22	22.13
O ₃ : <i>Ghanjivamrut</i> @ 5 t/ha	22.48	21.45	21.97
S.Em.±	1.06	0.91	0.70
C.D. (P = 0.05)	NS	NS	NS
Biodynamics (B)			
B ₁ : Control	20.50	19.19	19.85
B ₂ : BD 500 (65 g/ha) soil spray at one day before planting, 30 and 60 DAP	23.10	23.54	23.32
B ₃ : BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP	22.19	22.71	22.45
B ₄ : B ₂ + B ₃	23.48	23.69	23.58
S.Em.±	1.22	1.05	0.80
C.D. (P = 0.05)	NS	3.07	2.29
Interaction			
O×B	NS	NS	NS
Y×O, Y×B, Y×O×B	-	-	NS
C.V.%	16.42	14.09	15.30

Effect of biodynamics on curing percentage

Effect of biodynamics with respect to curing percentage was failed to produce significant effect during the 2023-24 of study but found significant in 2024-25 and pooled results. Significantly higher curing percentage of 23.69 and 23.59% was recorded with treatment B₄ (BD 500) (65 g/ha) soil spray at one day before planting, 30 and 60 DAP + BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP), which was statistically at par with treatment B₂ (BD 500) (65 g/ha) soil spray at one day before planting, 30 and 60 DAP) in year 2024-25 and pooled, respectively whereas, treatment B₁ (control) recorded significantly lower curing percentage of 19.19 and 19.85% 2024-25 and pooled, respectively. This may be due to improved physiological maturity, better dry matter accumulation and efficient post-harvest recovery under biodynamic management. Enhanced nutrient uptake and microbial activity likely contributed to uniform tissue

development and biomass retention during curing, resulting in minimal variation across organic manure treatments. Similar observations were reported by Sharma *et al.* (2012) [5] in cumin and Giannattasio *et al.* (2013) [4].

Interaction Effect

It is evident from data that combined effect of organic manures and biodynamics treatments failed to manifest their significant effect on curing percentage during 2023-24, 2024-25 and on pooled data.

Curcumin content

Data pertaining to curcumin content (%) affected by organic manures and biodynamics and its interaction effect during two consecutive years 2023-24, 2024-25 and in pooled are presented in Table 1.2.

Table 1.2: Effect of organic manures and biodynamics on curcumin content

Treatments	Curcumin content (%)		
	2023-24	2024-25	Pooled
Organic manures (O)			
O ₁ : FYM @ 15 t/ha	2.67	2.45	2.56
O ₂ : Vermicompost @ 5 t/ha	2.64	2.48	2.56
O ₃ : <i>Ghanjivamrut</i> @ 5 t/ha	2.70	2.58	2.64
S.E.m.±	0.05	0.05	0.03
C.D. (P = 0.05)	NS	NS	NS
Biodynamics (B)			
B ₁ : Control	2.64	2.42	2.53
B ₂ : BD 500 (65 g/ha) soil spray at one day before planting, 30 and 60 DAP	2.72	2.60	2.66
B ₃ : BD 501 (2.5 g/ha) foliar spray at 60, 90 and 120 DAP	2.67	2.52	2.60
B ₄ : B ₂ + B ₃	2.65	2.48	2.57
S.E.m.±	0.06	0.06	0.04
C.D. (P = 0.05)	NS	NS	NS
Interaction			
O×B	NS	NS	NS
Y×O, Y×B, Y×O×B	-	-	NS
C.V.%	6.33	6.80	6.55

Effect of biodynamics on curcumin content

Effect of biodynamics with respect to curcumin content was failed to produce significant effect during both the years and pooled results of study.

Interaction effect

The interaction effect between organic manures and biodynamics was failed to produce significant effect on curcumin content(%) during both the years and in pooled.

Conclusion

Based on the findings of the two year experimentation, it can be concluded that soil application of *ghanjivamrut* @ 5 t/ha with foliar spray of BD 500 (65 g/ha) at one day before planting, 30 and 60 days after planting (DAP) during sunset in the descending period of the moon, as well as BD 501 (2.5 g/ha) at 60, 90 and 120 days after planting (DAP) during sunrise in the ascending period of the moon enriched curcumin content of turmeric under organic cultivation in North Gujarat agro-climatic zone.

In addition, seed treatment with *bijamrut* @ 200 ml/kg of rhizomes, soil application of *jivamrut* @ 500 L/ha at the time of planting and subsequently at 30, 60, 90, 120 and 150 DAP, along with intercropping of sunhemp and it used as green mulch at 45 days after sowing of sunhemp.

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