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Study the profile and knowledge level of turmeric growers regarding use of biofertilizers

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ABSTRACT

The present study was undertaken to study the profile and knowledge level of turmeric growers regarding the use of biofertilizers in Sangli district of Maharashtra. The study was conducted in four selected tehsils, namely Miraj, Tasgaon, *Palus* and Walwa. A total of 160 turmeric growers were selected from 10 villages through simple random sampling. An ex-post-facto research design was adopted for the study. Data was collected through a pre-tested structured interview schedule and analyzed using appropriate statistical tools such as frequency and percentage. The findings of the investigation revealed that the majority of the respondents belonged to the middle-age group (55.00%), had primary education (39.37%), possessed medium farming experience (49.38%) and had medium experience in turmeric cultivation (50.00%). More than half of the respondents exhibited low social participation (53.75%), medium extension contact (56.87%) and medium source of information (68.12%), marginal land holding (43.12%), medium annual income (35.00%), medium marketing behaviour (53.75%), medium risk orientation (58.12%), medium innovativeness (55.63%) and medium economic motivation (53.12%). With regard to knowledge about use of biofertilizers, the study indicated that 59.38 per cent of the turmeric growers possessed a medium level of knowledge, while 23.75 per cent had a low level and 16.87 per cent had a high level of knowledge. The findings indicate that although turmeric growers had awareness regarding biofertilizers, there is still a need to strengthen their technical knowledge regarding different types, recommended doses, methods of application and proper use of biofertilizers. Therefore, regular training programmes, demonstrations and effective extension services are necessary to improve the knowledge level of turmeric growers and promote the scientific use of biofertilizers.

Keywords: Turmeric growers, Biofertilizers, Knowledge, Profile characteristics, Adoption

1. Introduction

Agriculture plays a vital role in the Indian economy and the productivity of crops largely depends on the efficient use of agricultural inputs, particularly fertilizers. Chemical fertilizers have contributed significantly to increasing agricultural production; however, their continuous and indiscriminate use has raised concerns regarding deterioration of soil fertility, reduction in beneficial microbial activity and environmental sustainability. These concerns have increased the importance of eco-friendly and sustainable nutrient management practices.

Biofertilizers are preparations containing beneficial living microorganisms that enhance the availability of plant nutrients and promote plant growth. These microorganisms contribute to biological nitrogen fixation, phosphorus solubilization and improvement of soil biological activity. Different microorganisms such as *Azospirillum*, *Azotobacter*, Phosphate Solubilizing Bacteria (PSB) and other beneficial microbes are widely used for improving nutrient availability and maintaining soil health. Biofertilizers are considered an important component of Integrated Nutrient Management as they complement other nutrient sources and support sustainable crop production (Magarvadiya *et al.*, 2014) [1].

Turmeric (*Curcuma longa* L.) is an important commercial spice crop with considerable culinary, medicinal and economic value (Hiremath, 2011) [2]. India is a major producer, consumer and exporter of turmeric and Maharashtra is among the important turmeric-growing states. Sangli district occupies a significant position in turmeric production and marketing and is well known for its quality turmeric. The increasing demand for turmeric in domestic and international markets has further emphasized the need for sustainable and efficient production practices (Kaushalkumar, 2012) [3].

Turmeric is a nutrient-exhaustive crop and requires balanced nutrient management for optimum growth, rhizome development and productivity. Excessive dependence on chemical fertilizers may affect soil health and long-term crop sustainability. In this context, the use of biofertilizers offers potential benefits by improving nutrient availability, enhancing soil microbial activity and supporting sustainable turmeric cultivation. Biofertilizers such as *Azospirillum*, *Azotobacter* and PSB can play an important role in improving nutrient-use efficiency when used along with appropriate organic and inorganic nutrient sources.

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However, the effectiveness of any agricultural technology depends largely on the knowledge and understanding of farmers regarding its proper use. Knowledge regarding the type of biofertilizer, recommended dose, method and time of application, storage and expected benefits is essential for its effective utilization. Inadequate or incomplete knowledge may result in improper application and reduced effectiveness of biofertilizers (Bhople *et al.*, 2002) [4]. Farmers' profile characteristics such as age, education, farming experience, landholding, social participation, extension contact and information sources may also influence their exposure to agricultural information and understanding of improved technologies.

Despite the potential benefits of biofertilizers in sustainable agriculture, their scientific use among farmers may be influenced by variations in knowledge and access to technical information (Chavan, 2015) [5]. Understanding the profile characteristics and knowledge level of turmeric growers is therefore important for designing effective extension strategies and capacity-building programmes.

2. Methodology

The present study was conducted in Sangli district of Maharashtra state. The district was purposively selected due to its importance in turmeric cultivation. Four tehsils, namely Miraj, Tasgaon, Palus and Walwa, were purposively selected because of their larger area under turmeric cultivation and higher concentration of turmeric growers.

An ex-post-facto research design was employed for the study. A total of 10 villages were selected from the four selected tehsils based on the concentration of turmeric growers. The list of turmeric growers was obtained from the Agricultural Assistants of the Department of Agriculture in the respective villages. A total of 160 turmeric growers were selected through simple random sampling for the investigation.

The data was collected through personal interviews using a structured and pre-tested interview schedule. The schedule was prepared in consultation with the research guide and advisory committee members and was initially developed in English and subsequently translated into Marathi for better understanding by the respondents. Pre-testing was carried out with 15 turmeric growers who were not included in the final sample and necessary modifications were made before final data collection (Kankate *et al.*, 2018) [6].

The profile characteristics studied included age, education, farming experience, experience in turmeric cultivation, social participation, extension contact, source of information, landholding, annual income, marketing behaviour, risk orientation, innovativeness and economic

motivation. The knowledge level of turmeric growers regarding the use of biofertilizers was measured using a structured knowledge schedule developed for the study. Each correct response was assigned a score of one, whereas no knowledge was assigned a score of zero. Based on the total knowledge score, the respondents were classified into low, medium and high knowledge categories using the range method (Kamble *et al.*, 2024) [7].

The collected data were compiled, tabulated and analyzed using appropriate statistical tools such as frequency and percentage.

3. Result and discussion

The profile characteristics of turmeric growers provide an important basis for understanding their socio-economic and psychological background, which may influence their access to agricultural information and knowledge regarding the use of biofertilizers.

A)

Profile characteristics of turmeric growers.

3.1 Age

The study revealed that the majority of turmeric growers (55.00%) belonged to the middle-age group (36-55 years), followed by 31.25 per cent in the young-age group (up to 35 years), while 13.75 per cent belonged to the old-age group (56 years and above). The age of the respondents ranged from 25 to 56 years. The predominance of middle-aged growers may be attributed to their active involvement in farm operations, decision-making and turmeric cultivation. The present findings are similar to those reported by Ingale *et al.* (2024) [8], who also found that the majority of respondents belonged to the middle age group.

3.2 Education

The findings revealed that the largest proportion of turmeric growers (39.37%) had primary education, followed by 36.25 per cent with secondary education. Further, 12.50, 10.63 and 1.25 per cent of the respondents had higher secondary, undergraduate and postgraduate education, respectively. None of the respondents was illiterate. Overall, 75.62 per cent of the turmeric growers had education up to the secondary level. This educational background may have facilitated their understanding of information related to improved cultivation practices and biofertilizer use. Similar results were reported by Ingale *et al.* (2024) [8], who observed that the majority of the respondents had studied up to the primary or secondary level.

Sr. No.	Category	Age Group (Years)	Frequency (N = 160)	Percentage (%)
1.	Young	Up to 35 yrs.	50	31.25
2.	Middle	36 yrs. to 55 yrs.	88	55.00
3.	Old	56 yrs. and above	22	13.75
Total			160	100.00
Min = 25 Max = 56				

Sr. No	Category	Standard of Education	Frequency (N = 160)	Percentage (%)
	Illiterate	Can't read / write	00	00.00
2. 2.	Primary Education	1 st to 7 th Std.	63	39.37
3. 3.	Secondary Education	8 th to 10 th Std.	58	36.25
4. 4.	Higher Secondary Education	11 th to 12 th Std.	20	12.50
5. 5.	Under Graduation	UG degree	17	10.63
6. 6.	Post-Graduation	PG degree	02	01.25
Total			160	100.00

3.3 Farming experience

The findings revealed that nearly half of the turmeric growers (49.38%) belonged to the medium farming experience group, followed by 26.87 per cent with high farming experience and 23.75 per

cent with low farming experience. Overall, 76.25 per cent of the respondents had medium to high farming experience. The farming experience ranged from 11 to 35 years. The predominance of medium and high farming experience may be attributed to the continuous involvement of the growers in farming activities and the practical

knowledge acquired through years of farming experience. The present findings are similar to those reported by [Sonawane et al. \(2009\) \[9\]](#), [Lad \(2014\) \[10\]](#) and [Ekhande et al. \(2020\) \[11\]](#), who found that the

majority of turmeric growers had medium farming experience.

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
1.	Low	Up to 19 Years	38	23.75
2.	Medium	Between 20 to 27 Years	79	49.38
3.	High	28 Years and Above	43	26.87
Total			160	100.00
Range = 08.00 Min = 11 Max = 35				

3.4 Experience in turmeric cultivation

The findings revealed that half of the turmeric growers (50.00%) belonged to the medium group of experience in turmeric cultivation (9-14 years), followed by 25.63 per cent with low experience (up to 8 years) and 24.37 per cent with high experience (15 years and above). Overall, 74.37 per cent of the respondents had medium to high experi-

ence in turmeric cultivation. The experience ranged from 3 to 19 years. The predominance of medium-level experience may be attributed to the continuous involvement of the growers in turmeric cultivation, which helped them acquire practical knowledge and experience regarding various crop production practices. The findings were similar to [Chinchmalatpure et al. \(2023\) \[12\]](#) that the respondent medium experience in turmeric cultivation.

Sr. No.	Category	Score	Frequency(N = 160)	Percentage (%)
	Low	Up to 8 years	41	25.63
2.	Medium	Between 9 to 14 years	80	50.00
3. 3.	High	15 years and above	39	24.37
Total			160	100.00
Range = 05.33 Min = 03 Max = 19				

3.5 Social participation

The findings revealed that a majority of the turmeric growers (53.75%) belonged to the low land-holding group, followed by 35.00 per cent in the medium group and 11.25 per cent in the high land-holding group. Overall, 88.75 per cent of the respondents belonged to

the low and medium land-holding categories. The predominance of low landholdings may be attributed to fragmentation and subdivision of agricultural land among farm families. The present findings are similar to those reported by [Hipparkar \(2015\) \[13\]](#) and [Mutteppa et al. \(2020\) \[14\]](#) who observed that the majority of respondents had low level social participation.

Sr. No.	Category	Score	Frequency(N = 160)	Percentage (%)
1.	Low	Up to 8	86	53.75
2.	Medium	Between 10 to 12	56	35.00
3.	High	13 and above	18	11.25
Total			160	100.00
Range = 03.66 Min = 04 Max = 15				

3.6 Extension contact

The findings revealed that the majority of turmeric growers (56.87%) belonged to the medium social participation group, followed by 28.13 per cent in the low group and 15.00 per cent in the high group. The predominance of medium social participation may be attributed to

farmers' involvement in various agricultural and community organizations, which provided opportunities for interaction, information exchange and exposure to improved agricultural practices. The present findings are similar to those reported by [Borse \(2020\) \[15\]](#) and [Patel et al. \(2021\) \[16\]](#), who found that the majority of respondents had medium extension contact.

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
	Low	Up to 08	45	28.13
2. 2.	Medium	Between 09 to 12	91	56.87
3. 3.	High	13 and above	24	15.00
Total			160	100.00
Range = 04.00 Min = 04 Max = 16				

3.7 Source of information

The findings revealed that the majority of turmeric growers (68.12%) belonged to the medium annual income group, followed by 18.13 per cent in the high-income group and 13.75 per cent in the low-income group. Overall, 86.25 per cent of the respondents belonged to the medium and high annual income categories. The predominance of

medium-income respondents may be attributed to regular income from turmeric cultivation and other agricultural activities. The relatively better economic position of the respondents may have enabled them to invest in improved agricultural inputs and technologies such as biofertilizers. The present findings are similar to those reported by [Nigade et al. \(2017\) \[17\]](#), [Shende et al. \(2020\) \[18\]](#) and [Ingale et al.](#)

(2024) [8], who observed that the majority of respondents had a medium level of use of information sources

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
2.	Low	Up to 07	22	13.75
2.	Medium	Between 08 to 12	109	68.12
3.	High	13 and above	29	18.13
Total			160	100.00
Range = 04.33 Min = 03 Max = 16				

3.8 Land holding

The findings revealed that the majority of respondents (43.12%) belonged to the marginal landholding category, followed by 36.90% with small landholdings. About 15.68% of respondents had semi-

medium landholdings, whereas only 4.30% possessed medium landholdings. None of the respondents had large landholdings. Overall, 80.02% of the respondents had marginal and small landholdings, indicating that turmeric cultivation in the study area was predominantly practiced by small and marginal farmers.

Sr. No.	Category	Frequency (N = 160)	Percentage (%)
2.	Marginal (up to 1.00 ha)	69	43.12
2.	Small (1.01 to 2.00 ha)	59	36.90
3.	Semi-medium (2.01 to 4.00 ha)	25	15.68
4.	Medium (4.01 to 10.00 ha)	07	04.30
5.	Large (more than 10.00 ha)	00	00.00
Total		160	100.00
Min = 0.4 Max = 4.5			

3.9 Annual income

The findings revealed that 35.00 per cent of respondents belonged to the medium annual income category, followed by 23.75 per cent in the low-income category. About 19.37 per cent had high income, while 13.75 and 8.13 per cent belonged to very-low and very-high in-

come categories, respectively. Thus, the majority of respondents belonged to the medium-income category. The present findings are similar to those reported by Nigade *et al.* (2017) [17], Pathade (2017) [19], who observed that the majority of respondents belonged to the medium annual income group.

Sr. No.	Category	Income Range	Frequency (N = 160)	Percentage (%)
1	Very Low	Up to ₹ 4,50,000	22	13.75
2	Low	Between ₹ 4,50,001 to ₹6,00,000	38	23.75
3	Medium	Between ₹ 6,00,001 to ₹7,50,000	56	35.00
4	High	Between ₹ 7,50,001 to ₹9,00,000	31	19.37
5	Very High	₹9,00,001 and above	13	08.13
Total			160	100.00
Range = 1,50,000 Min = 3,00,000 Max = 10,50,000				

3.10 Marketing behaviour

The findings revealed that 53.75 per cent of respondents had a medium level of the measured attribute, followed by 29.37 per cent with a high level. About 16.88 per cent of respondents belonged to the

low category. Thus, the majority of respondents (53.75%) were in the medium category. The present findings are similar to those reported by Katole *et al.* (2018) [20], Sravani (2020) [21] who found that the majority of respondents had a medium level of marketing behaviour.

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
1	Low	Up to 10	27	16.88
2	Medium	Between 11 to 14	86	53.75
3	High	15 and above	47	29.37
Total			160	100.00
Range = 04.00 Min = 06 Max = 18				

3.11 Risk orientation

The findings revealed that 58.12 per cent of respondents belonged to the medium category, followed by 25.63 per cent in the high category. About 16.25 per cent of respondents belonged to the low category.

Thus, the majority of respondents (58.12%) were in the medium category. The present findings are similar to those reported by Shende *et al.* (2020) [18], Rempuii (2022) [22], who found that respondents had a medium level of risk orientation.

Sr. No.	Category	Score	Frequency(N = 160)	Percentage (%)
1	Low	Up to 22	26	16.25
2	Medium	Between 23 to 28	93	58.12
3	High	29 and above	41	25.63
Total			160	100.00

Range = 06.66 Min = 15 Max = 35

3.12

Innovativeness

The findings revealed that 55.63 per cent of respondents belonged to the medium category, followed by 24.37 per cent in the high category. About 20.00 per cent of respondents belonged to the low category. Thus, the majority of respondents (55.63%) were in the medium category. The present findings are similar to those reported by Bihare

(2015) [23] and Nigade *et al.* (2017) [17], who observed that the majority of respondents had a medium level of innovativeness.

3.13 Economic motivation

The findings revealed that 53.12 per cent of respondents belonged to the medium category, followed by 33.75 per cent in the high category. About 13.13 per cent of respondents belonged to the low category. Thus, most respondents (53.12%) were in the medium category.

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
1	Low	Up to 08	32	20.00
2	Medium	Between 09 to 12	89	55.63
3	High	13 and above	39	24.37
Total			160	100.00

Range = 04.00 Min = 04 Max = 16

Sr. No.	Category	Score	Frequency (N = 160)	Percentage (%)
1	Low	Up to 28	21	13.13
2	Medium	Between 29 to 34	85	53.12
3	High	35 and above	54	33.75
Total			160	100.00

Range = 05.33 Min = 23 Max = 39

B) 4.2.1 Knowledge level of turmeric growers regarding use of biofertilizers

The findings revealed that 59.38 per cent of respondents belonged to the medium category, followed by 23.75 per cent in the low category. About 16.87 per cent of respondents belonged to the high category.

Thus, the majority of the respondents (59.38%) were in the medium category. The present findings are similar to those reported by Purohit *et al.* (2014) [24], Yamgar (2013) [25] and Talpe *et al.* (2011) [26] who also observed that the majority of respondents had a medium level of knowledge regarding recommended agricultural practices and biofertilizer use.

Table 1. Classification of respondents according to their overall knowledge level of turmeric growers regarding use of biofertilizers

Sr No	Category	Score Range	Frequency (N = 160)	Percentage (%)
1	Low	Up to 12	38	23.75
2	Medium	13 to 17	95	59.38
3	High	18 and above	27	16.87
Total			160	100.00

Range = 04.33 Min = 08 Max = 21

The findings revealed that respondents had relatively higher knowledge regarding the expiry period of biofertilizers (75.62%), their role in rhizome rot management (73.12%) and biological nitrogen fixation (70.62%). Knowledge was comparatively lower regarding proper dosage (48.75%) and application near the root zone (55.00%). Overall, respondents demonstrated better knowledge of the general benefits and uses of biofertilizers, while some gaps existed in their technical application practices.

Table 2. Statement wise classification of respondents according to their specific knowledge level regarding use of biofertilizers

Sr. No.	Particulars	Frequency (N = 160)	
		Yes	No
1	Biofertilizers are beneficial micro-organisms for improving soil fertility in turmeric cultivation. (+)	103 (64.37)	57 (35.67)

Sr. No.	Particulars	Frequency (N = 160)	
		Yes	No
2	<i>Azospirillum</i> is important for nitrogen fixation in turmeric crop (+)	94 (58.75)	66 (41.25)
3	Exposure to high temperature and direct sunlight reduces the shelf life of biofertilizers. (+)	97 (60.62)	63 (39.37)
4	Proper dosage of biofertilizers helps in efficient nutrient availability for turmeric plants. (+)	78 (48.75)	82 (51.25)
5	<i>Azotobacter</i> is important for use in non-leguminous crops like turmeric. (+)	89 (55.62)	71 (44.37)

(continued on next page)

Sr. No.	Particulars	Frequency (N = 160)	
		Yes	No
6	Phosphate Solubilizing Bacteria (PSB) are recommended to increase phosphorus availability in turmeric fields. (+)	102 (63.75)	58 (36.25)
7	Biofertilizers are important for rhizome treatment before planting turmeric (+)	101 (63.12)	59 (36.87)
8	Biofertilizers for turmeric include <i>Azospirillum</i> , <i>Azotobacter</i> and PSB. (+)	107 (66.87)	53 (33.12)
9	Important soil application dose of <i>Azospirillum</i> and PSB (approximately 10 kg per hectare). (+)	94 (58.75)	66 (41.25)
10	Important dose of <i>Azotobacter</i> (approximately 4 kg per hectare) for turmeric cultivation. (+)	94 (58.75)	66 (41.25)
11	Biofertilizers should be mixed with well-decomposed FYM or compost before soil application. (+)	102 (63.75)	58 (36.25)
12	Biofertilizers are applied at the time of planting or during early crop growth stage. (+)	105 (65.62)	55 (34.37)
13	Biofertilizers help in good germination. (+)	105 (65.62)	55 (34.37)
14	Biofertilizers can be applied near the root zone through drenching or spraying. (+)	88 (55.00)	77 (48.12)
15	Biofertilizers should not be mixed directly with chemical fertilizers or pesticides. (+)	107 (66.87)	53 (33.12)
16	Biofertilizers help in biological nitrogen fixation in soil (+)	113 (70.62)	47 (29.37)
17	Biofertilizers help in solubilizing unavailable phosphorus in soil. (+)	97 (60.62)	63 (39.37)
18	Biofertilizers are important for management of rhizome rot in turmeric. (+)	117 (73.12)	41 (25.62)
19	Biofertilizers should be stored in a cool and dry place away from direct sunlight. (+)	99 (61.87)	61 (38.12)
20	Biofertilizers have a specific expiry period and should be used before expiry date. (+)	121 (75.62)	39 (24.37)
21	Biofertilizers are available at Agricultural Universities, KVKs and authorized input centers. (+)	105 (65.67)	55 (34.37)
22	Important use of biofertilizers improves soil health and increases turmeric yield. (+)	113 (70.62)	47 (29.37)

4. Conclusion

The study revealed that the majority of the turmeric growers were middle-aged, had primary-level education and possessed medium levels of farming experience and experience in turmeric cultivation. Most respondents belonged to the medium annual income category and possessed marginal landholdings. Most of the turmeric growers also exhibited medium levels of social participation, source of information, extension contact, marketing Behaviour, risk orientation, innovativeness and economic motivation, indicating a moderate socio-

economic, communication and psychological profile. With respect to knowledge regarding the use of biofertilizers, the majority (59.38%) of turmeric growers had a medium level of knowledge, followed by low (23.75%) and high (16.88%) levels. The findings indicate that turmeric growers possessed a moderate level of knowledge regarding the use of biofertilizers. Therefore, there is scope for strengthening farmers' knowledge through effective agricultural information and extension interventions to promote the scientific use of biofertilizers in turmeric cultivation.

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