



Extent of Adoption of Recommended Pomegranate (*Punica granatum* L.) Cultivation Practices among Growers in Maharashtra, India

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Authors' contributions

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

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Abstract

India ranks second in the world in total fruit production, with production estimates around 106 million tonnes annually, behind China's roughly 242+ million tonnes. Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat, Bihar, and Uttar Pradesh are the main fruit-growing states in India. The present study was conducted in Maharashtra with the specific objective of determining the "Adoption Level of Pomegranate Growers." Nashik, Solapur, and Ahmednagar (Ahilyanagar) districts were purposively selected, as they are among the major pomegranate growing districts in the state. A total of 180 pomegranate growers were selected from six tehsils across these districts. Descriptive statistics were used for data analysis. The findings revealed that the majority (67.78%) of pomegranate growers had a medium level of adoption of recommended cultivation practices, followed by 18.33% with a high level of adoption and 13.89% with a low level of adoption.

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1. Introduction

Agriculture is the backbone of the Indian economy and continues to play a crucial role despite sustained efforts toward industrialization. India ranks as the world's second-largest producer of fruits, with major fruit-growing states including Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat, Bihar, and Uttar Pradesh (Jakkawad et al., 2017, Manoj et al., 2024, Mishra and Jahanara, 2019, Mohit et al., 2017). Owing to its diverse edapho-climatic conditions, the country is well suited for cultivating a wide range of tropical and subtropical fruits such as mango, banana, citrus, guava, grape, pineapple, and apple. In recent years, several minor fruits, particularly pomegranate, have gained importance in India's expanding horticultural sector. Pomegranate (*Punica granatum* L.), locally known as anar, dalim, or matulum, is an important fruit crop cultivated in tropical and subtropical regions of India and is valued for its nutritional and medicinal properties. Although pomegranate is well adapted to Indian conditions, its average productivity remains relatively low compared to its potential, posing a significant challenge for both researchers and farmers (Anonymous, 2022, Singh, 2005, Yadav et al., 2007, Sawale, 2011).

One of the major reasons for low productivity is the limited adoption of recommended cultivation technologies by farmers. Many growers have not fully embraced scientific practices such as single-stem training, application of biofertilizers, fruit bagging, and the use of protective covers for pest and disease management and quality improvement (Atar et al., 2012, Bhandare et al., 2013, Chavhan et al., 2015). The lack of awareness and knowledge regarding these improved practices contributes significantly to the existing technological gap (Shirale et al., 2025, Singh, 2005). Furthermore, it is evident that several socio-economic and institutional factors, in addition to the recommended package of practices, directly or indirectly influence farmers' decisions to adopt or reject new technologies. Considering these circumstances, the present study was undertaken to assess the level of knowledge among pomegranate growers regarding recommended cultivation practices (Ghadge and Fattepurkar, 2018, Jahanara and Bose, 2018, Deshmukh and Shinde, 2017).

The study was limited to selected pomegranate growers from Nashik, Ahmadnagar (Ahilyanagar), and Solapur districts of Maharashtra; therefore, the findings cannot be generalized to other regions. The results are applicable mainly to the study area, though they may be relevant to areas with similar conditions.

1.1 Objectives

To identify and thoroughly examine the causes of the technological gap in pomegranate cultivation to address the issue of poor adoption of recommended practices.

2. Methodology

In Maharashtra, pomegranate is cultivated extensively in the districts of Nashik, Ahmednagar (Ahilyanagar), Solapur, Sangli, Pune, Dhule, Aurangabad, Satara, Latur, and Dharashiv. Considering the area under pomegranate cultivation, Nashik, Solapur, and Ahmednagar (Ahilyanagar) districts were purposively selected for the study. Pomegranate is grown in all talukas of these three districts. To identify the major pomegranate-growing talukas, all talukas were arranged in ascending order based on the area under pomegranate cultivation in each district. From this list, six talukas, namely Malegaon, Satana, Pandharpur, Sangola, Sangamner, and Rahata, were selected for the investigation.

A total of 18 villages from the selected talukas were purposively chosen based on the concentration of pomegranate growers. Further, 10 pomegranate growers were randomly selected from each village, resulting in a total sample size of 180 respondents. The study followed an ex-post facto research design. A multistage sampling technique was employed for the selection of districts, talukas, and villages. Primary data were collected through personal interviews using a structured interview schedule covering relevant variables. The collected data were coded, classified, tabulated, and analysed using appropriate statistical methods to draw meaningful conclusions.

3. Results and Discussion

3.1. Overall Adoption Level of Pomegranate Growers

According to the data presented in Table 1, the majority (67.78%) of pomegranate growers had a medium level of adoption of recommended pomegranate cultivation practices. This was followed by 18.33 per cent of growers who had a high level of adoption, while 13.89 per cent had a low level of adoption.

Table 1. Distribution of the pomegranate growers according to their level of adoption

Sl. No.	Category	Frequency	Percentage
1.	Low (Up to 76)	25	13.89
2.	Medium (77 to 92)	122	67.78
3.	High (93 and above)	33	18.33
	Total	180	100.00
Mean=	84.54		S.D.= 8.45

It can be assumed that the overall adoption level of an individual may be influenced by key factors such as medium extension contact, good social participation, and satisfactory farming experience. Furthermore, most pomegranate growers possess medium to high levels of knowledge regarding recommended cultivation practices (Pasha et al., 2016, Pradhan et al., 2017, Raghuprasad et al., 2018). This knowledge supports their decision-making ability and encourages the adoption of improved farming practices.

3.2 Recommended Practice Wise Adoption of Pomegranate Growers

A. Soil and Climate: It was observed from Table 2 that 34.45% of the pomegranate growers had full adoption and 65.55% had partial adoption of the recommended practice “Selection of soil – light to medium.” Regarding climatic requirements (sub-tropical and tropical regions), 46.66% of the growers had full adoption, while 53.33% had partial adoption.

B. Plant Spacing and Variety: The data indicate that 48.33% of pomegranate growers had full adoption and 51.66% had partial adoption of the recommended plant spacing (4.5×3.0 m). In case of recommended varieties (Mrudula, Phule Aarkta, Bhagawa, Phule Bhagwa Super, and Solapur Lal), 49.44% of growers had full adoption, while 50.55% had partial adoption of using recommended planting material.

C. Intercropping: Regarding intercropping (initially after 2 years of plantation), 45% of growers had full adoption, 36.67% had partial adoption, and 18.33% had no adoption. For the recommendation “Do not grow solanaceous and cucurbitaceous crops as intercrops,” only 0.55% had full adoption, 71.66% had partial adoption, and 27.77% had no adoption.

D. Selection of Planting Material and Land Preparation: For selecting planting material from government-approved nurseries, 31.67% of growers had full adoption, 51.67% had partial adoption, and 16.67% had no adoption. In case of planting material from Gutti kalam, 86.11% had full adoption and 13.89% had partial adoption. However, adoption of tissue culture planting material was very low, with only 5.00% having full adoption, 13.33% partial adoption, and 81.67% no adoption. Regarding selection from healthy, disease-free and good-yielding mother orchards (free from oily spot and wilt), 35.56% had full adoption and 64.44% had partial adoption. For deep ploughing during summer and soil solarization (2–3 months), 32.78% had full adoption, 52.22% partial adoption, and 15.00% no adoption. For digging pits of $60 \times 60 \times 60$ cm, 38.89% had full adoption, 57.78% partial adoption, and 3.33% no adoption.

E. Flowering: For selection of Ambe bahar, 67.78% had full adoption and 32.22% had partial adoption. For Mrug bahar, 43.33% had partial adoption and 56.67% had no adoption. For Hasta bahar, 10.00% had partial adoption and 90.00% had no adoption. Bahar treatment through withholding irrigation water showed very high adoption, with 98.33% full adoption and 1.67% no adoption. Regarding the use of chemicals for defoliation (e.g., Ethrel, Curacron), 61.67% had full adoption and 38.33% had partial adoption.

F. Training: All (100%) of the pomegranate growers had no adoption of single-stem training and full adoption of multi-stem training practices.

G. Pruning: For sterilizing pruning tools with disinfectants (e.g., detergents or Dettol), 48.89% had full adoption, 47.78% partial adoption, and 5.56% no adoption. For removal of dead, diseased, and crisscross branches, 52.78% had full adoption and 47.78% had partial adoption. For spraying Bordeaux mixture (1%) immediately after pruning, 61.67% had full adoption, 36.11% partial adoption, and 2.22% no adoption.

H. Method of Irrigation: Application of drip irrigation was widely adopted, with 95.00% having full adoption and 5.00% partial adoption. Flood irrigation showed lower adoption, with 45.56% partial adoption and 54.44% no adoption. For combined drip and flood irrigation, 2.22% had full adoption, 45.56% partial adoption, and 52.22% no adoption.

I. Manure and Fertilizer Management: For application of FYM @ 40–50 kg per tree (after five years), 96.67% had full adoption and 3.33% had partial adoption. For application of recommended dose of fertilizers (625 g N, 250 g P, 250 g K per plant per year in split doses), 35.56% had full adoption, 61.67% partial adoption, and 3.33% no adoption. Application of micronutrients (Calcium, Boron, Iron, Magnesium, Zinc) showed 25.00% full adoption, 71.11% partial adoption, and 3.89% no adoption. For bio-fertilizers, 15.56% had full adoption, 51.67% partial adoption, and 32.78% no adoption. Regarding management of major diseases like oily spot and wilt, 21.67% had full adoption and 78.33% had partial adoption (Morwal et al., 2019, Naik and Deshmukh, 2016).

J. Integrated Disease and Pest Management: For awareness of major pests (pin hole borer, stem borer, nematodes, fruit fly, and sucking pests), 45% had full adoption and 55% had partial adoption. For biological control methods, 21.11% had full adoption, 56.11% partial adoption, and 27.22% no adoption. For use of recommended chemicals, 38.33% had full adoption and 61.67% had partial adoption. For following disease control schedules recommended by Agricultural University and NRC Pomegranate (for oily spot and wilt), 4.44% had full adoption, 70.55% partial adoption, and 25% no adoption. Use of fruit bagging or protection covers showed very low adoption, with 4.44% full adoption, 21.11% partial adoption, and 74.44% no adoption.

L. Yield: All (100%) of the pomegranate growers had full adoption regarding knowledge of fruit maturity period and production per tree. For grading of fruits, 74.44% had full adoption and 27.76% had partial adoption.

Table 2. Practice wise adoption of recommended cultivation practices of pomegranate growers

Sr. No.	Particulars	Extent of Adoption					
		Full		Partial		No	
		F	%	F	%	F	%
A. Soil and Climate							
1.	Selection of Soil -light to medium	62	34.45	118	65.55	00	0
2.	Climatic condition required for crop growth (sub-tropical and tropical regions)	84	46.66	96	53.33	0	0
B. Plant spacing and Variety							
3.	Plant spacing- 4.5×3.0 m.	87	48.33	93	51.66	0	0
4.	Use of planting material of recommended variety - Mrudula, Phule Aarkta, Bhagawa, Phule bhagwa super, Solapur Lal	89	49.44	91	50.55	0	0
C. Intercropping							
5.	Intercrops- initially after 2 years of plantation.	81	45	66	36.67	33	18.33
6.	Don't grow Solanaceae and Cucurbitaceae crops as intercrop crops.	01	0.55	129	71.66	50	27.77
D. Selection of planting material and Land preparation							
7.	Selection of planting material for planting should be from government approved nursery.	57	31.67	93	51.67	30	16.67
8.	Selection of planting material from Gutti kalam	155	86.11	25	13.89	0	0.00
9.	Selection of planting material from tissue culture	9	5.00	24	13.33	147	81.67

Sr. No.	Particulars	Extent of Adoption					
		Full		Partial		No	
		F	%	F	%	F	%
10.	Selection of planting material from healthy, disease free and good yielding mother orchard (Oily spot and wilt)	64	35.56	116	64.44	0	0.00
11.	Deep ploughing during summer season and explore soil for solarization for 2-3 month.	59	32.78	94	52.22	27	15.00
12.	Digging of pits by 60 X 60 X 60 cm cube	70	38.89	104	57.78	6	3.33
E. Flowering							
13.	Selection of Bahar - Ambe bahar	122	67.78	58	32.22	0	0.00
14.	Selection of Bahar – Mrug bahar	00	00	78	43.33	102	56.67
15.	Selection of Bahar – Hasta bahar	00	00	18	10.00	162	90.00
16.	Bahar treatment with holding of irrigation water	177	98.33	00	00	3	1.67
17.	Use of chemicals for defoliation e.g. Ethel, Cuaron etc.	111	61.67	69	38.33	0	0.00
F. Training							
18.	Training with single stem	0	0	0	0	180	100.0
19.	Training with multi stem	180	100.0	0	0.00	0	0.00
G. Pruning							
20.	Sterilized the pruning tools with disinfectant like Detergents or Dettol	88	48.89	86	47.78	10	5.56
21.	Removing of dead, disease and crisscross branches	95	52.78	86	47.78	0	0.00
22.	Immediately after pruning orchard should be sprayed with Bordo mixture @ 1%	111	61.67	65	36.11	4	2.22
H. Method of Irrigation							
23.	Application of Drip Irrigation	171	95.00	9	5.00	0	0.00
24.	Application of Flood Irrigation	0	0.00	82	45.56	98	54.44
25.	Application of Drip Irrigation + Flood Irrigation	4	2.22	82	45.56	94	52.22
I. Manure and Fertilizers management							
26.	Application of FYM @ 40-50 kg per tree after five years onwards	174	96.67	6	3.33	0	0.00
27.	Application of RDF @ 625 g N, 250 g P and 250 g K per plant per year. Split doses of N equally in two weeks. This dose is applicable to five-year age onwards orchard	64	35.56	111	61.67	6	3.33
28.	Application of micronutrients with Calcium, Boron, Ferrous, Magnesium and Zinc.	45	25.00	128	71.11	7	3.89
29.	Application of bio fertilizers	28	15.56	93	51.67	59	32.78
30.	Infestation of major diseases like oily spot and wilt	39	21.67	141	78.33	00	00
J. Integrated Disease and Pest Management							
31.	Occurrence of pin hole borer, stem borer, nematodes, fruit fly and sucking pest	81	45	99	55	0	0
32.	For controlling this disease and pests use biological methods	38	21.11	101	56.11	49	27.22
33.	For controlling this disease and pests use recommended Chemicals	69	38.33	111	61.66	00	00
34.	For controlling oily spot and wilt disease farmers can follow a disease control schedule recommended by Agricultural University and NRC, Pomegranate.	8	4.44	127	70.55	45	25
35.	Use of fruit Bagging or protection covers for	8	4.44	38	21.11	134	74.44

Sr. No.	Particulars	Extent of Adoption					
		Full		Partial		No	
		F	%	F	%	F	%
	controlling pest, diseases as well as improving fruit quality.						
L. Yield							
36.	Time requires for the maturity of fruit.	180	100.00	00	00	00	00
37.	Production of pomegranate fruits per one tree	180	100.00	00	00	00	00
38.	Grading of fruits	134	74.44	50	27.78	00	00

4. Conclusion

The study concluded that the majority (67.78%) of pomegranate growers had a medium level of adoption of recommended cultivation practices, followed by 18.33 percent with high adoption and 13.89 percent with low adoption. High adoption was observed in flowering management, drip irrigation, manure application, and fruit maturity practices. All growers followed multi-stem training, while none adopted single-stem training. Moderate adoption was noticed in soil selection, spacing, intercropping, and fertilizer management practices. However, low adoption was recorded in the use of tissue culture planting material and biological pest management methods.

Overall, the findings indicate that although several recommended practices are being followed, there is considerable scope to enhance adoption of scientific cultivation practices through effective extension services, training, and demonstrations to improve productivity and sustainability of pomegranate cultivation.

Consent

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

Disclaimer (Artificial Intelligence)

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

Competing Interests

Authors have declared that no competing interests exist.

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**BHAGWANT UNIVERSITY, AJMER (RAJASTHAN)
DEPARTMENT OF AGRICULTURE EXTENSION AND COMMUNICATION**

	<u>INTERVIEW SCHEDULE</u>
RESEARCH TOPIC :	A STUDY ON KNOWLEDGE AND ADOPTION OF RECOMMENDED CULTIVATION PRACTICES AMONG POMEGRANATE GROWERS IN MAHARASHTRA.
Researcher: Mr. Jadhav Ramesh Madhav	Research Guide : Dr. Amit Kumar Mishra
Degree Programme: Ph.D. (Agril. Extension and Communication)	

PART- I

A) Personal Information

Interview Scheduled No.

1. Name of Farmer :
2. Mobile No. :
3. Village :
4. Tahsil :
5. District :

B) Profile of Beneficiary

- 1) Age : years.
- 2) Education :
- 3) Family size: Men :
- Women :
- Children :
- Total :

4) Land holding : ha.

Sr.no.	Land Holding	Area(ha)
1	Marginal	Up to 1 ha
2	Small	1.01ha to 2 ha
3	Semi medium	2.01 to 4ha
4	Medium	4 4.01 to 10 ha
5	Large	10 ha above

5) Farming Experience : years

6) Annual family income:

Main source : Rs.

Subsidiary : Rs.

Total: Rs.

7) Social participation: YES/NO

If yes please tell about it.

Sl. No.	Name of organization	Position held			Since when
		Member	Office bearer	No participation	
	Formal organization				
1	Gram panchayat				
2	Panchayat samiti				
3	Zilla parishad				
4	Co-operative society				
5	Bank				
	Informal organization				
1	Farmer club				
2	Youth club				
3	Self Help Group				
4	Mahila mandal				
5	Any other				

8. Extension Contact:

Sr. No.	Sources	Regular	Occasionally	Never
		2	1	0
1	Gramsevak			
2	Agri. Assistant			
3	Agri. Extension Officer			
4	Agri. Officer			
5	B. D. O.			
6	University Scientists / KVK Scientists			
7	Any other			

PART II**A. Knowledge and Adoption of recommended cultivation practices among pomegranate growers**

Some questions given below related to knowledge and adoption of recommended cultivation practices among pomegranate growers in Maharashtra. Kindly give appropriate answer to it.

Sl. No.	Statement	Knowledge		Extent of Adoption		
		Yes (2)	No (1)	Full (3)	Partial (2)	No (1)
A.	Soil and Climate					
20.	Selection of Soil -light to medium					
21.	Climatic condition required for crop growth (sub-tropical and tropical regions)					
B.	Plant spacing and Variety					
22.	Plant spacing- 4.5×3.0 m.					
23.	Use of planting material of recommended variety - Mrudula, Aarkta, Bhagawa, Phule bhagwa super, Solapur Lal					
C.	Intercropping					
24.	Intercrops- initially after 2 years of plantation.					
25.	Don't grow solanaceace and Cucurbitaceae crops as intercrop crops.					
D.	Selection of planting material and Land preparation					
26.	Selection of planting material for planting should be					

	from government approved nursery.					
27.	Selection of planting material from Gutti kalam					
28.	Selection of planting material from tissue culture					
29.	Selection of planting material from healthy, disease free and good yielding mother orchard (Oily spot and wilt)					
30.	Deep ploughing during summer season and explore soil for solarisation for 2-3 month.					
31.	Digging of pits by 60 X 60 X 60 cm cube					
E.	Flowering					
32.	Selection of Bahar - Ambe bahar					
33.	Selection of Bahar – Mrug bahar					
34.	Selection of Bahar – Hasta bahar					
35.	Bahar treatment with holding of irrigation water					
36.	Use of chemicals for defoliation e.g. Ethrel, Curacron etc.					
F	Training					
37.	Training with single stem					
38.	Training with multi stem					
G	Pruning					
20.	Sterilized the pruning tools with disinfectant like Detergents or Dettol					
21.	Removing of dead, disease and crisscross branches					
22.	Immediately after pruning orchard should be sprayed with Bordo mixture @ 1%					
H.	Method of Irrigation					
23.	Application of Drip Irrigation					
24.	Application of Flood Irrigation					
25.	Application of Drip Irrigation + Flood Irrigation					
I	Manure and Fertilisers management					
26.	Application of FYM @ 40-50 kg per tree after five year onwards					
27.	Application of RDF @ 625 g N, 250 g P and 250 g K per plant per year. Split doses of N equally in two weeks. This dose is applicable to five year age onwards orchard					
28.	Application of micronutrients with Calcium, Boron, Ferrus, Magnesium and Zinc .					
29.	Application of bio fertilizers					
J.	Integrated Disease and Pest Management					
30.	Infestation of major diseases like oily spot and wilt					
31.	Occurrence of pin hole borer , stem borer, nematodes ,fruit fly and sucking pest					
32.	For controlling this disease and pests use Biological methods					
33.	For controlling this disease and pests use recommended Chemicals					
34.	For controlling oily spot and wilt disease farmers can follow a disease control schedule recommended by Agricultural University and NRC ,Pomegranate.					
35.	Use of fruit Bagging or protection covers for controlling pest, diseases as well as improving fruit quality.					
K	Yield					
36.	Time require for the maturity of fruit.					

37.	Production of pomegranate fruits per one tree					
38.	Grading of fruits					

PART III

Constraints faced by pomegranate growers in adoption of recommended production practices

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