Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers

A thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH

RAHURI, DIST – AHMEDNAGAR

MAHARASHTRA (INDIA)

in partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION

by

MS. THAKUR SAYALI VILAS

Reg. No. 12/193

EXTENSION EDUCATION SECTION

COLLEGE OF AGRICULTURE, PUNE

MAHARASHTRA (INDIA)

2014

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Dr. V. S. Shirke
Chairman and Research Guide
Professor of Agril. Extension
College of Agriculture, Pune

Dr. H. P. Sonawane
Committee Member
Asst. Prof. of Agril. Extension
College of Agriculture, Pune

Dr. S. M. Galande
Committee Member
Asst. Prof. of Agril. Entomology
College of Agriculture, Pune

CANDIDATE'S DECLARATION

I hereby declare that this thesis entitled **Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers** or part thereof has not been submitted by me or any other person to any other university or institute for Degree or Diploma.

Place: Pune
Date: / / 2014 **(Sayali Vilas Thakur)**

Dr. V. S. Shirke
Chairman and Research Guide
Professor of Agril. Extension
College of Agriculture, Pune
Maharashtra, India.

CERTIFICATE

This is to certify that the thesis entitled **Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers** submitted to the faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra State in partial fulfilment of the requirements for the award of degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION**, embodies the results of a piece of bonafide research work carried out by **MS. THAKUR SAYALI VILAS** under my guidance and supervision, and that no part of the thesis has been submitted for any other Degree or Diploma.

Her assistance and help received during the course of this investigation have been acknowledged.

Place: Pune **V. S. Shirke**

Date: / / 2014 Chairman and Research Guide

Dr. A. R. Karale
Associate Dean and Principal
College of Agriculture, Pune
Maharashtra, India.

CERTIFICATE

This is to certify that the thesis entitled **Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers** submitted to the faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra State under the guidance and supervision of **DR. V. S. SHIRKE**, Professor of Agril. Extension, College of Agriculture, Pune in partial fulfillment of the requirements for the award of degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION**, embodies the results of a piece of bonafide research work carried out by **MS. THAKUR SAYALI VILAS** and that no part of the thesis has been submitted for any other Degree or Diploma.

Place: Pune **A. R. Karale**

Date: / / 2014 Associate Dean

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I thank God for the wisdom and perseverance that he has been bestowed upon me throughout my life.

Finally, I wish to offer my thanks to all those whom I am able to recall here and also to those I might have left unknowingly.

Place: Pune

Date: / / 2014 *(Sayali Vilas Thakur)*

APPENDIX- I

List of villages selected from two tehsils of Kolhapur district for the study on 'Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers'

Sr. No.	Name of Village	Respondents Selected
	Chandgad Tehsil	
1	Kowad	List of the mango growers from these villages was prepared and 51 respondents were selected.
2	Channehatti	
3	Jakkanahatti	
4	Yertanahatti	
5	Teurwadi	
6	Rajgoli Budruk	
7	Rajgoli Khurd	
8	Surute	
9	Turkewadi	
10	Shinoli Budruk	
11	Shinoli Khurd	
12	Tudiye	
13	Hajgoli	
14	Date	
15	Halarwadi	
16	Halkarni	
17	Narewadi	
18	Nittur	
19	Shivnage	
20	Mangaon	
21	Dukkarwadi	

	Gadhinglaj Tehsil	
1	Kadgaon	List of the mango growers from these villages was prepared and 54 respondents were selected.
2	Shendri	
3	Manwad	
4	Terani	
5	Halkarni	
6	Basarge Budruk	
7	Basarge Khurd	
8	Lingnur	
9	Mahagaon	
10	Waghrali	
11	Bidrewadi	
12	Nesari	

APPENDIX-II

महा□मा फुले कृ□ष □वदयापीठ, राहुर□

कृ□ष महा□व□यालय, पुणे

□व□तार □श□ण □वभाग

एम. एस. सी. (कृ□ष) □व□तार □श□ण अ□यासांतगत संशोधनासाठ□ची □□नावल□

संशोधन □क□प : □पक संर□ण प□□तींवषयी आंबा उ□पादक शेतक-यांचे □ान आ□ण अवलंबन.

□व□याथ□नीचे नाव: कु. ठाकूर सायल□ □वलास **मागदशक:** डॉ. □ह□एस. □शाक□

□ा□यापक, कृ□ष □व□तार □वभाग

कृ□ष महा□व□यालय, पुणे

□□नावल□

भाग 1 : शेतक-याची वैय□□तक मा□हती

1. अ. शेतक-याचे नाव :

ब. प□ता : **गाव :** **तालुका :**

2. वय : वष□

3. □श□ण :

4. धारण केलेले ज□मनीचे □े□ :

अ.□.	ज□मनीचा □कार		□े□		
			हे□टर	एकर	आर / गुंठे
अ	एकूण □े□				
	1	जिरायत			
	2	बागायत			
	3	पडीक			
ब	आंबा □पकाखालील □े□				

5. एकूण वार्षिक उत्पन्न :

अ.क्र.		उत्पन्नाचा मार्ग	उत्पन्न (रु)
1	अ	शेती अ. एकूण उत्पन्न	
		ब. आंबा प्रकापासुन प्रमळणारे उत्पन्न	
2		दुग्धम व्यवसाय	
	अ		
	ब		
	क		
		एकूण	

6. माहिती प्रमळविण्याचे मार्ग:

अ. क्र.	माहिती प्रमळविण्याचे मार्ग			नेहमी	कधीतरी	कधीच नाही
अ	**व्यक्तिगत संपर्क माध्यमे**					
	1	कुटुंबातील सदस्य / नातेवाईक / मित्र				
	2	प्रगतीशील शेतकरी				
	3	कार्यक्रमक नेते				
ब	**समुह / गट संपर्क माध्यमे**					
	1	प्रशिक्षणे के	1 कृषि प्रशिक्षणे के			
			2 परिणाम प्रशिक्षणे के			
	2	सभा				
	3	गटचर्चा				
	4	शैक्षणिक सहल				
	5	शेतकरी मेळावा				
क	**सामुदायिक संपर्क माध्यमे**					
		रेडिओ				
		i	कृषि वार्ता			
		ii	आमच घर आमच शिवार			
		iii	कृषि दर्शन			
	2	दूरदर्शन				
		i	डी. डी. वन			
		ii	सह्याद्री (आमची माती आमची माणस)			
		iii	ई. टी. व्ही. (अन्नदाता)			

		iv	इतर			
	3	वर्तमानपत्रे				
		i	आठवडी			
		ii	इतर वर्तमानपत्रे			
	4	शेतीसाहित्य/ नियतकालिके/ मासिके				
		i	शेतकरी			
		ii	बळीराजा			
		iii	गोडवा			
		iv	इतर			
	5	विद्यापीठ प्रकाशने				
		i	कृषिदर्शनी			
		ii	दीपसुगी			
		iii	घडीपत्रिका			
		iv	अतीपत्रिक			
		v	इतर			
ड	**इतर**					
	1	इंटरनेट				
	2	कृषि एस. एम. एस सेवा				
	3					

7. विस्तार कार्यकर्त्या/आपण विस्तार यंत्रणा यांच्याशी असलेला संपर्क :

अ. क्र.	विस्तार संपर्क स्रोत		नेहमी	कधीतरी	कधीच नाही
अ	**कृषि विद्यापीठ / भारतीय कृषि अनुसंधान परिषद**				
	1	कृषि विद्यापीठ			
	2	कृषि महाविद्यालय			
	3	कृषि विज्ञान केंद्र			
	4	विभागीय विस्तार केंद्र			
	5	कृषि संशोधन केंद्र			
	6	कृषि तंत्रज्ञान माहिती केंद्र			
	7	शेतकरी शास्त्रज्ञ मंच सभासद			
	8	आंबा संशोधन केंद्र			
	9	किसान कॉल सेंटर			

ब	**कृ□ष □वभाग (महारा□□ शासन)**				
	1	तालुका कृ□ष अ□धकार□			
	2	कृ□ष सहा□यक / सेवक			
	3	कृ□ष उ□प□न बाजार स□मती			
क	**जि□हा प□रषद / पंचायत स□मती**				
	1	□ामप□वकास अ□धकार□ (□ह□डीओ)			
	2	□ामसेवक			
ड	**अशासक□य संपक□ □□ोत**				
	1	कृ□ष सेवा क□			
	2	□क्रसान कॉल सट्टर			
इ	**इतर**				
	1				
	2				

8. □पक संर□ णासाठ□ वापर□यात येणार□ उपकरणे / यं□ :

अ. □.	**उपकरण / यं□**		**सं□ या**	**मालक□**	**भा□यान**
1	□□ेयर				
	अ	पॉवर □□ेयर			
	ब	पॅडल □□ेयर			
	क	नॅपसॅक □□ेयर			
	ड	गटूर □□ेयर			
2	ड□टर				
	इतर				

भाग 2 : शेतक-या□या आंबा □पका□वषयी व मा□हती

1. आंबा लागवडी□वषयी तपशील दया.

अ.□	**जातीचे नाव**	**लागवडीचे वष□**	**□ा□ हे□टर**	**झाडांची सं□ या**	**उ□पादन □ती हे□टर**	**उ□प□न □पये**
1						
2						
3						
4						

2 . आं□यावरा□ल □कडी व रोगां□या □नयं□णासाठ□ केले □या □शफरशी□वषयी आपणास असले□या मा□हती□वषयी व अवलंबना□वषयी तपशील □या.

अ.□	□शफरस केलेल □ प□त	औषध □□त 10 □लटर पा□यात	माहती			अवलंबन		
			पूणतः	अंशतः	काह□ नाह□	पूणतः	अंशतः	काह□ नाह□
अ	□कडी							
1	आं□यावरा□ल तुडतुडे							
अ	फवारणी वेळाप□क							
i	पा□हल□ फवारणी स□टबर अखेरा□स □कंवा ऑ□टोबर□या पा□ह□या आठवडयात करावी. (कोवळी पालवी व तुडतुडे अस□यास)							
	सायपरमे□ीन 25 % □वाह□/ फेन □हलरेट 20 % □वाह□/ डे□टामे□ीन 2.8 % □वाह□	3 □म.ल□ 5 □म.ल□ 9 □म.ल□						
ii	दुसर□ फवारणी डोळे □कंवा बा□ो फुटताच करावी.							
	□वनालॅफॉस 25 % □वाह□	20 □म.ल□						
iii	□तसर□ फवारणी दुस-या फवारणी नंतर करावी सुमारे दोन आठवडयाने करावी.							
	इ□मडॉ□लो□ीड 17.8 % □वाह□/ □लोथाय□नडीन 50 %	3 □म.ल□ 1.2 □ॅम						
iv	चौथी फवारणी □तस-या फवारणी नंतर सुमारे दोन आठवडयांनी करावी.							
	थायोमेथॉ□झाम 25 % (पा□यात □मसळणारे दाणेदार □कटकनाशक)	1 □ॅम						
v	पाचवी फवारणी चौ□या फवारणी नंतर सुमारे दोन आठवडयांनी करावी.							
	फे□थोएट 50 % □वाह□/ डायमेथाएट 30 % □वाह□	20 □म.ल□ 10 □म.ल□						
vi	सहावी फवारणी पाच□या फवारणी नंतर सुमारे दोन आठवडयांनी करावी.							
	पाच□या फवारणीम□ये सुच□वले□या क□टकनाशकापैक□ न वापरलेले (गरज अस□यास)	---						
2	फुल □कड							
अ	□पनोसॅड 45 % □वाह□	2.5 □म.ल□						
ब	मो□या □माणात □दुभाव अस□यास	2 □ॅम						

	थायोमेथॉ□झाम 25 % पा□यात □मसळणारे दाणेदार □कटकनाशक							
3	**फळमाशी**							
अ	□□त हे□टर□ 4 □माणात र□ क सापळे बागेत वेगवेग□ या □ठकाणी लावावेत.							
4	**खोडक□डा**							
अ	तारे□या हुकाने अळया काढून टाका□यात.							
ब	□छ□ात इडीसीट□ □कंवा अ□यु□मनीअम फॉ□फाइडची गोळी टाकावी व □छ□ □यखलाने बंद करावे.							
5	**शङ्डा पोखरणार□ अळी**							
अ	□वनॉलफॉस 25 % □वाह□	20 □म.ल□						
6	**□मठया ढेकूण**							
अ	बुं□यालगत 2 % □मथील पॅरॅ□थऑन भुकट□ □□त झाडास 100 □ॅम या □माणात टाकावी.	100 □ॅम						
ब	□लोरोपाय□रफॉस 20% □वाह□ / □ोफेनोफॉस 20% □वाह□ व □यात 10 □म.ल□ □टकर □कंवा 25 □ॅम □फश ऑईल रो□झन सोप □मसळावे	20 □म.ल□ 20 □म.ल□						
क	या अळीची □म□ले झाडांवर चढू नयेत □हणून खोडवर ज□मनीपासून एक फूट अंतरावर □थम □यखलाने खोडां□या भेगा बुजवून □या□यात व 400 गेजची □लॅ□ट□कची 30 से. मी. □द□यी पा□ी बुं□याभोवती □याव□थित बसवावी.							
7	**वाळवी**							
अ	वाळवीचे वा□ळ शोधून वाळवी□या राणीचा व वा□ळाचा नाश करावा							
ब	50 % □वाह□ □मथील पॅरॅ□थऑन □कंवा 20% □वाह□ □लोरोपाय□रफॉस	2 □म.ल□ 5 □म.ल□						

ब	**रोग**							
1	**फांद□मर**							
अ	पावसा□यात उघडीप बघून कॉपर ऑ□सी□लोराईड □क्ंवा मॅ□कोझेब □क्ंवा 1 ट□के बोड□□म□ णा□या फवार□या □या□या.	30 □ॅम 30 □ॅम						
ब	□ादुभा□न फांद□ तोडवी व जाळून टाकवी आ□ण तोडले□या भागावर बोड□ पे□ट लावावी.							
2	**करपा**							
अ	पालवी, मोहोर व फळे यांवर काबन्ाडॅ□झम □क्ंवा कॉपर ऑ□सी□लोराईड □क्ंवा 1 ट□के बोड□□म□ ण फवारावे.	10 □ॅम 25 □ॅम						
3	**भुर□**							
अ	स□फर □क्ंवा काबन्ाडॅ□झम □क्ंवा हे□झाकोनझॉल □क्ंवा थायोफा□नट मे□थल □क्ंवा □ॉ□पनेब	20 □ॅम 10 □ॅम 5 □म.ल□ 10 □ॅम 20 □ॅम						
4	**फळकुज**							
अ	काढणी नंतर □ादु□भा□न फळे 0.05 % काबन्ाडॅ□झम□या □ावणात 10 □म बुडवून पुसून □पकत घाला□वत.	5 □ॅम						
क	**□पक संर□ णाचे इतर उपाय**							
1	**बांडगुळ**							
अ	□नय□मत अमर बांडगुळ कटरने □क्ंवा कोयती □क्ंवा कु-हाडी□या सहा□याने बांडगुळ फांद□सह तोडणे. □युट□लोर 0.03 % □क्ंवा □लु□लोरलाम 0.3 % □क्ंवा □□यायफोसेट 0.5 बांडगुळ कढले□या फांद□वर लावणे.							

ब	बांडगुळ पुणतः नट कर यासाठ बांडगुळ कढले या फांदावर युटॅ लोर 0.03 % कंवा लु लोरलम 0.3 % कंवा ायफोसेट 0.5 % ची फवारणी करावी.						
क	**इतर वकार**						
1	**फळ गळ**						
अ	फळे वाटा या आकाराची झा यावर 2 % यु या तसेच एन. ए. ए 20 पी. पी. एम हे ऑि झनवगय संजीवक फवारावे.						
2	**पॅ लो यु ॉझॉलचा वापर**						
अ	पॅ लो यु ॉझॉल या वाढ वरोधक संजीवका या वापरामुळे झाडांमधे जि लां स सार या वाढ उ तेजका या म मात्रीम ये य यय येऊन अवाजवी शाखीय वाढ कमी होते आ ग मय मत मोहोर येऊन फलधारणा हो यास मदत होते. पॅ लो यु ॉझॉल वषातून एकदा 15 जुलै ते 31 ऑग ट दर यान पूण वाढले या (10 वषावरील) झाडाला यावे. झाडाचा पुव प चिम व उ तर - द ण यास मोजुन याची सरासर काढुन न मीटर यासास 0.75 ॅम या शील घटक (3 म.ल क टारचे ावण) पॅ लो यु ॉझॉल यावे. पॅ लो यु ॉझॉलची मा ा 3 ते 6 लटर पा यात मसळुन झाडा या बुं याभोवती यावी. झाडा या बुं याभोवती वतारा या म या अंतरावर खणतीने 10 ते 12 से. मी. खोल असे सम अंतरावर 25 ते 30 ख डे मा न यात तयार केलेले ावण सम माणात ओतावे व नंतर ख डे बुजवून यावेत.						

5. आंबा □पक संर□ ण कर□यासाठ□ आपणास येणा-या अडचणी तसेच □या □नवा-या□यासाठ□ आप□या सूचना सांगा.

अ.□	अडचणी	✓	सूचना
अ	**□ ान**		
1	□कडी व रोग ओळखता येत नाह□.		
2	□कडी व रोगामुळे हो□या-या नुकसानाचे □व□प माह□त नाह□		
3	□कडी व रोगा□या □नयं□णा□वषयी माह□ती नाह□.		
ब	**उपकरणे**		
1	फवारणी यं□ भा□याने □मळत नाह□.		
2	नादु□□त यं□े दु□□त कर□याची सोय नाह□.		
3	फवारणी यं□े महाग असतात.		
क	**औषधे**		
1	औषधे वेळेवर □मळत नाह□.		
2	औषधे महाग असतात.		
3	औषधंचे □म□ण क□न यो□य □रतीने वापर करता येत नाह□		
4	काह□वेळा औषधांवर छा□पल □कंमत नस□याने □वकत घेताना □कंमतीम□ये फसवणुक होते.		
5	स□□य व जै□वक □कटकनाशका□या नावाखाल□ काह□ बनावट कंप□यांकडून फसवणुक होते.		
ड	**आ□थक**		
1	औषधे फवारणी□या वेळी पैसे उपल□ध नसतात.		
2	फवारणी यं□े व औषधे □वकत घेणे परवडत नाह□		
इ	**कामगार / मजूर**		
1	फवारणीसाठ□ कुशल मजूर □मळत नाह□.		
2	मजूर वेळेवर □मळत नाह□.		
3	मजूर□ जा□त आहे.		
ई	**हवामान बदल**		
1	पावसाळा लांब□यामुळे आव□यक फवार□या वेळेत		

	घेता येत नाही.		
2	फवारणी करुन झाडयावर अचानक पाऊस पडल्यास फवारलेले किटकनाशके व बुरशीनाशके झाडावर न टिकता वाहून जातात.		
फ	**इतर अडचणी**		

ABSTRACT

Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers

by

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Mango (*Mangifera indica* L.) is the major fruit crop grown in the country. Irrespective to the reality that India is having a comparative advantage with respect of diverse agro-climate and soil type over other mango producing countries in terms of total production still the productivity (7.2 tonnes/ha) continues to be low.

As mango is susceptible to incidence of different pests and diseases, their occurrence is the important factor influencing its production and productivity. The loss of yield in mango is due to occurrence of different pest and diseases and inability to control the same by growers due to lack of knowledge. Generally, it is observed that mango growers do not adopt plant protection measures on large scale, which is one of the main constraints in increasing the productivity.

Taking into consideration all these facts, present investigation was carried out in two tehsils *viz;* Chandgad and Gadhinglaj of Kolhapur

district from western Maharashtra. The data were collected by interviewing 105 mango growers with the help of well-designed and pre-tested schedule.

The objectives of the study were to study the profile of mango growers, their extent of knowledge and level of adoption regarding plant protection measures. To study the constraints faced and suggestions made by the mango growers regarding plant protection measures.

The study revealed that three- fifth (60.00 per cent) of the mango growers were belonged to ómiddleô age group, majority (37.14 per cent) of the mango growers had education up to ósecondary levelô, two- fifth (40.00 per cent) of the mango growers had ósemi- mediumô (2.01 to 4.00 ha) size of land holding, majority (70.48 per cent) of the mango growers had ósmallô area (Up to 1.00 ha) under mango cultivation, more than two-fifth (41.90 per cent) of the mango growers had annual income between ` 1,00,001 to ` 2,00,000, most of the (82.86 per cent) mango growers were getting ómediumô income (` 11,943- ` 87,199) through mango production, more than three- fifth (62.86 per cent) of the mango growers had ómediumô information sources, less than one- half (44.76 per cent) of the mango growers had ólowô level of extension contact, more than one-third (37.14 per cent) of the mango growers were using knapsack sprayer.

It was observed that the majority (65.71 per cent) of the mango growers had ómediumô level of knowledge and majority (66.67 per cent) of the mango growers had ómediumô level of adoption regarding plant protection measures.

Lack of technical and scientific guidance regarding plant protection measures, lack of knowledge regarding quantity and concentrations of

chemicals to be used and lack of knowledge regarding identification of pests, their nature of damage, diseases and their symptoms, unavailability of required insecticides and fungicides at village level, high cost of plant protection chemicals and equipments, unavailability of plant protection equipments on hire basis, lack of facilities for repairing plant protection equipments at village level, lack of finance and sudden rainfall after spraying causes washing off plant protection were the major constraints faced by the mango growers.

Information regarding recommended doses of insecticides and fungicides should be given by expert personnel at village level, training should be organized more often at village level for mango growers regarding identification of pests, their nature of damage, diseases and their symptoms, information about recommended plant protection measures should be displayed at public places, need to establish good linkages between farmers and research system for proper guidance, insecticides and fungicides should be made available on time at village level, cost of plant protection chemicals and equipments should be reduced, plant protection equipments of high cost should be made available on hire basis at village level, facilities for repairing plant protection equipments should be provided at village level, financial support should be provided by the government, outbreak weather situations should be forecasted regularly through newspaper or TV channel and establishment of Agri- clinic at village level were important the suggestions made by the mango growers to overcome the constraints regarding adoption of plant protection measures.

1. INTRODUCTION

India is endowed with diverse agro-climate and soil type which is unique advantage for a wide range of horticultural crops. At present, next to China, India is the second largest producer of fruits. Mango (*Mangifera indica* L.) belonging to family Anacardiaceae is the worldôs leading fruit crop and it is the second most important commercially grown fruit crop of the country after banana. It is eulogized as the ôKing of fruitsô. It is also recognized as the ôNational fruit of Indiaô. It is believed that mango originated from South East Asia and its cultivation in southern Asia has been traced back to more than six thousand years in past.

Economic importance of mango is more because the fruit is very popular with the masses due to its wide range of adaptability. Mango is a rich source of Beta- carotene which is the precursor of vitamin A and source of vitamin C also.

India has the richest collection of mango cultivars which are grown in a wide range of agro- climatic conditions from tropical to subtropical and humid tropics to semi humid tropics. However, only a few varieties are commercially cultivated throughout India. The main mango varieties grown on commercial basis are Alphonso, Kesar, Banganpalli, Mallika, Dashehari, Langra, Fajli, Chausa, Totapuri, Neelum etc.

The Indian scenario of horticulture indicates that India ranks first among worldôs mango producing countries. Mango is grown over an area of 2.50 million hectares which contributes 35.80 per cent of total area under fruit crops in India. The production of mango in India is 18.00 millon tonnes with 22.10 per cent share in fruit production of country (Indian Horticulture Database, 2012- 13).

The leading state in area under mango is Andhra Pradesh (0.49 million ha) followed by Maharashtra (0.48 million ha) and Uttar Pradesh (0.27 million ha). The other important states in mango cultivation are Orissa (0.20 million ha), Karnataka (0.19 million ha), Tamil Nadu (0.15 million ha), Bihar (0.14 million ha) and Gujarat (0.14 million ha). The production of mango is highest in Andhra Pradesh (4.41 million tonnes) followed by Uttar Pradesh (4.39 million tonnes), Karnataka (1.80 million tonnes), Bihar (1.36 million tonnes), Gujarat (1.00 million tonnes), Orissa (0.75 million tonnes) and Tamil Nadu (0.71 million tonnes) whereas, the production of mango in Maharashtra is 0.63 million tonnes. The highest productivity of mango is in Uttar Pradesh (16.01 tonnes/ha) followed by Karnataka (10.04 tonnes/ha). (Indian Horticulture Database, 2012- 13).

India is a prominent exporter of fresh mangoes. The major countries where mangoes are exported from India are United Arab Emirates (67.60 per cent) followed by Bangladesh (8.37 per cent), United Kingdom (5.94 per cent), Nepal (4.03 per cent), Saudi Arabia (3.00 per cent), Qatar (2.74 per cent) and Kuwait (1.49 per cent). In the year 2012- 13, export of mango from India was of 55,585 tonnes which was accountable to ` 264.72 crores.

Irrespective to the reality that India is having a comparative advantage over other mango producing countries in terms of total production still the productivity (7.2 tonnes/ha) continues to be low. The productivity of mango in Maharashtra (1.3 tonnes/ha) also tends to be very low as compare to other major mango growing states in India. As mango is susceptible to incidence of different pests and diseases, their occurrence is the important factor influencing its production and productivity.

The first factor is the pest infestation, which affects the production and productivity of mango adversely. The crop has been reported to be infested by 551 pests in the different parts of the world, which include 492 species of insects, 17 species of mites, 26 species of nematodes, 9 species of birds and 7 species of animals. Mango hopper, fruit flies, mealy bug, stem borer, shoot borer and thrips are considered as the major pests in our country. In India, the greatest damage to the mango crop is caused by mango hoppers and they are responsible for the total crop failure.

The other factor influencing production of the mango is infection of different diseases. All plant parts of mango like trunk, branches, leaves, petioles, flowers and fruits are attacked by various pathogens. These may be either fungi or bacteria. These pathogens cause several kinds of rots, die- back, anthracnose, scab, necrosis, blotch, spots, mildew etc. Some of these diseases are causing heavy losses in mango production in some regions. Powdery mildew has been known to cause a complete failure of the crop and is one of the worst diseases of mango affecting almost all the varieties. This disease alone causes approximately 20.00 per cent crop loss in Maharashtra state. Loranthus which grows as an ecto- parasite on mango tree and disorders like fruit drop and alternate bearing are also important factors affecting the production of the crop adversely.

With considerable changes in crop production practices and an appreciably improved extension service in last few decades, the country is yet to attain the goals of sustained economic growth in the agricultural sector. Now, the progress in agriculture depends on willingness and ability of farmers to use the new technology and required inputs. In this context, it is essential to understand the multidimensional behaviour of

the farmers for adoption of improved agricultural practices. The extent of adoption of innovation which is the function of various personnel and socio- psychological characteristics of farmers can be used as a tool to measure modernization in agriculture. Although, scientific research in agriculture is moving fast and new techniques are being added continuously but still adoption of these techniques is less. Hence, productivity levels of different crops are very low. The shifting focus has opened up great opportunities waiting to be exploited in the horticulture sector. The ground realities represent an exact picture of low yields of fruits, wide gaps in adoption of improved fruit cultivation practices and inadequate technical guidance. In order to increase the production and productivity of horticulture sector, it is necessary to increase the level of knowledge of the farmers about the recommended technologies which is a pre-requisite to the adoption process, so that adoption can also be increased.

The loss of yield in mango is due to occurrence of different pest and diseases and inability to control the same by the growers due to lack of knowledge. Generally, it is observed that mango growers do not adopt plant protection measures on large scale, which is one of the main constraint in increasing the average yield per hectare. Taking into consideration all these facts, it is necessary that mango growers should have knowledge about the appropriate plant protection measures and they should adopt those plant protection measures to keep their mango crop free from pest and disease infestations so that they can increase production and productivity of mango.

Keeping all the above facts in mind, present investigation entitled **'Knowledge and Adoption of Plant Protection Measures followed by the Mango Growers'** was carried out with the following objectives;

1.1 Objectives

1. To study profile of the mango growers.
2. To study the extent of knowledge of mango growers regarding plant protection measures.
3. To study the adoption level of plant protection measures followed by the mango growers.
4. To study constraints faced and suggestions made by the mango growers about plant protection measures.

1.2 Importance and Scope of the Study

Maharashtra ranks second in terms of area under mango crop but it occupies very low position in production and productivity of mango. As the occurrence of pests and diseases is the important factor in yield loss, hence this study was undertaken to understand knowledge level and extent of adoption of recommended plant protection measures followed by mango growers.

The outputs of this study will not only serve as indicators of prevailing conditions but also help the planners, scientists and extension personnel to overcome the problems in adoption of plant protection measures in mango.

The study has been mainly focussed on the knowledge level and extent of adoption of recommended plant protection measures as well as various constraints faced by the mango growers in its adoption.

Different pests and diseases were recorded on mango in Kolhapur district *viz.,* shoot borer, mango hoppers, termites, mealy bugs, stem borer, thrips, anthracnose, powdery mildew, die- back, flower drop, fruit

drop etc. (Patil, 2012). Hence, there is extreme need to control these various pests and diseases and to increase production and productivity of mango in area because of its bright future prospective. As very limited studies were carried out on mango crop in research area, it is decided to study the prevailing and recommended plant protection measures followed by the mango growers in that area so that future suggestions and recommendations could be made to improve the existing situation.

1.3 Limitations of the Study

As the study conducted by the student researcher, hence there are limitations with respect to time and other resources.

The findings of the study are based on the response of the respondents. Hence, the objectivity is limited to the extent of honesty and memory power of the respondents.

The area of study was restricted to only Chandgad and Gadhinglaj tehsils of Kolhapur district of Maharashtra so the findings emerged out of this study can not be generalized and applied to other tehsils and districts of Maharashtra, which may differ in situation.

2. REVIEW OF LITERATURE

2.1 Profile of the mango growers.

2.2 Extent of knowledge of mango growers regarding plant protection measures.

2.3 Adoption level of plant protection measures followed by the mango growers.

2.4 Constraints in adoption of plant protection measures followed by the mango growers.

2.5 Suggestions made by the mango growers about plant protection measures.

2.1 Profile of the mango growers

2.1.1 Age

Katkar (2001) revealed that majority (44.00 per cent) of the mango growers were belonging to óyoungô age group.

Misal (2002) reported that majority (64.00 per cent) of the respondents belonged to ómiddleô age group, while remaining respondents were distributed equally in óyoungô (18.00 per cent) and óoldô (18.00 per cent) age group.

Hassan *et al.* (2002) found that majority (50.67 per cent) of the respondents had ómiddleô age category, while less than one-fifth (18.00 per cent) of the respondents had óyoungô age category and about one-third (31.33 per cent) of the respondents belonged to óoldô age category.

Mirani (2007) indicated that majority of the farmers (50.00 per cent) and Nuclear Institute of Agriculture (NIA) scientists (75.00) belonged to the age group of 41-60 years.

Thippeswamy (2007) noted that majority of the respondents (58.12 per cent) belonged to ómiddleô age group. The respondents below 30 years of age were 18.12 per cent and 23.75 per cent of them were from óoldô age group.

Jadhav (2009) indicated that more than half of the mango growers (52.00 per cent) belonged to ómiddleô age category where as 29.33 per cent and 18.67 per cent of them belonged to óoldô age and óyoungô age categories respectively.

Godse (2010) revealed that a majority (81.33 per cent) of the respondents were in the ómiddleô age group, while 12.67 per cent of the respondents were in the óyoungô age group and remaining 6.00 per cent of them were in the óoldô age group. The average age of the respondents was 48 years.

Kanwat (2011) reported that a majority (53.33 per cent) of the respondents were in the ómiddleô age group, while 33.33 per cent of the respondents were in the óoldô age group and remaining 13.34 per cent of them were in the óyoungô age group.

Kota (2011) observed that majority (85.83 per cent) of the mango growers belonged to ómiddleô age category i.e. 36 to 55 years, while 10.83 per cent and 3.34 per cent of the respondents were from óoldô age and óyoungô age categories respectively. The average age of the mango growers was 47.15 years.

Surve (2012) found that 57.69 per cent of respondents were belonging to ómiddleô age group followed by óyoungô age group (31.53 per cent) and oldô age group (10.76 per cent).

Ugese *et al.* (2012) revealed that majority (50.00 per cent) of the respondents involved in mango fruit production fall within the age range of ó41-50 yearsô followed by the age bracket ó51-60 yearsô (34.00 per cent) and the age bracket ó31-40 yearsô (12.00 per cent.) The remaining respondents were distributed equally in age brackets of ó21-30 yearsô (02.00 per cent) and óover 60 yearsô (02.00 per cent).

Shojaei *et al.* (2013) reported that majority (51. 00 per cent) of the farmers belonged to age group of ó45 - 60 yearsô, while 25.00 per cent of them were belonging to age group of ó30 - 45 yearsô followed by age group of óabove 60 yearsô (19.10 per cent) and ôbelow 30 yearsô (04.40 per cent).

Tekale and Gavit (2013) depicted that majority of the respondents (64.00 per cent) belonged to ómiddleô age group (36 to 50 years).

2.1.2 Education

Katkar (2001) reported that 45.33 per cent of the respondents received primary education followed by ósecondary educationô (28.00 per cent) and very few (7.34 per cent) of them had received óhigher educationô, while 19.33 per cent of them were óilliteratesô.

Hassan *et al.* (2002) found that majority (40.00 per cent) of the respondents were óilliterateô followed by education óup to matricô (24.00 per cent), óabove matricô (23.33 per cent) and óup to primaryô (12.67 per cent).

Mirani (2007) reported that 21.70 per cent of the farmers received ógraduateô level of education and 13.30 per cent of the farmers were óilliterateô, while all the Nuclear Institute of Agriculture (NIA) scientists (100.00 per cent) received ópost graduateô level of education.

Thippeswamy (2007) indicated that in respect of formal education level obtained, 15.00 per cent of the respondents were ‘illiterates’, whereas 28.75 per cent of the respondents had received ‘primary’ education followed by ‘middle school’ education (24.37 per cent) and high school education (15.62 per cent), while only 11.25 per cent and 5.00 per cent of the respondents had education up to ‘PUC’ and ‘degree’ level respectively.

Lastimoza (2008) observed that majority (48.44 per cent) of the mango growers possessed ‘high school’ level education followed by ‘elementary’ (31.25 per cent) and ‘primary’ (20.31 per cent) level of education.

Jadhav (2009) indicated that with regard to education, 22.00 per cent of the mango growers studied up to ‘primary’ level, while 18.67 and 16.67 per cent of the respondents had education up to ‘pre-university’ and ‘graduation’ level respectively. Whereas, 17.33 per cent and 14.00 per cent of the respondents had studied up to ‘middle school’ and ‘high school’ levels respectively and 11.33 per cent of the respondents were ‘illiterate’.

Godse (2010) found that a maximum number (44.00 per cent) of the respondents had completed ‘graduation’ followed by ‘secondary’ education (31.33 per cent). An equal number (2.00 per cent each) of the respondents had ‘pre-primary’ and ‘post graduation’ level education. Only 2.67 per cent of the respondents had ‘primary’ education, while 18.00 per cent respondents had ‘higher secondary’ education.

Kanwat (2011) reported that a majority (33.33 per cent) of the respondents had ‘primary’ education followed by ‘high school’ (19.13 per

cent), middle school (17.50 per cent), ócollegeô (12.52 per cent), ógraduationô (8.33 per cent) and 9.16 per of them were óilliterateô

Kota (2011) revealed that nearly less than one - half (44.17 per cent) of the mango growers had ósecondary and higher secondaryô education i.e.8th std. to 12th std. Below one-fourth (23.33 per cent) of mango growers had ógraduationô education followed by óprimaryô (16.67 per cent) and ópost graduationô (8.33 per cent) education. Only 7.50 per cent of mango growers were óilliterateô. The average educational level of the mango growers was 10th standard.

Surve (2012) observed that majority (42.31 per cent) of the mango growers had education up to ósecondary and higher secondaryô level followed by óprimaryô education level (35.38 per cent) and óhigherô education level (15.38 per cent). It also revealed that 6.92 per cent of the mango growers are óilliterateô.

Ugese *et al.* (2012) found that with respect to educational attainment, majority (38.00 per cent) of the respondents had ópost primaryô education followed by óprimaryô education (32.00 per cent), 24.00 per cent of the respondents had óno formalô education, while few (06.00 per cent) attainedô tertiaryô education.

Shojaei *et al.* (2013) observed that majority (35.00 per cent) of the farmers had óprimaryô level of education and 13.20 per cent of them were óilliterateô.

Tekale and Gavit (2013) observed that most of the respondents (41.00 per cent) were found to be educated up to ócollege levelô whereas, 36.00 per cent of them were educated up to óhigh schoolô level.

2.1.3 Size of Land Holding

2.1.3.1 Total Land Holding

Katkar (2001) indicated that majority (55.00 per cent) of the mango growers were belonging to medium category of land holding.

Misal (2002) found that majority (33.00 per cent) of the respondents had ósemi-mediumô land holding (2.01 to 4.00 ha.), 26.00 per cent of the respondents had ómediumô land holding (4.01 to 10.00 ha.), while 16.00 per cent of the respondents had ósmallô land holding (1.01 to 2.00 ha.). óMarginalô (up to 1.00 ha.) and óbigô (above 10.01 ha.) land holdings were owned by 14.00 per cent and 11.00 per cent of the respondents respectively.

Khanolkar (2004) noted that majority of the mango and cashew growers had ómediumô land holding.

Thippeswamy (2007) revealed that ósmallô land holders category occupied the highest percentage (48.75 per cent) followed by 30.63 per cent of the respondents were ósemi-mediumô land holders, 11.87 per cent of respondents were ómediumô land holders. With a least of 6.25 per cent and 2.50 per cent of the respondents were ómarginalô and óbigô land holders respectively.

Wagale *et al.* (2007) indicated that the average size of holding of sample mango growers was ó2.54 haô.

Yadav *et al.* (2007) observed that land holding size of most of the orchardists was ómore than one acreô.

Godse (2010) found that 38.00 per cent and 40.00 per cent of the respondents had ósemi mediumô and ómediumô land holdings

respectively, while 11.33 per cent of the respondents had ósmallô land holdings and 10.67 per cent of the respondents had ólargeô land holding. The average land holding of the respondents was 5.24 ha, indicating ómediumô land holding.

Kanwat (2011) reported that majority (73.33 per cent) of the respondents were ómediumô farmers with land holding 10.00 ï 25.00 acres, while 15.83 per cent and 10.83 per cent of them were ósmallô and óbigô farmers with land holding 2.51- 5.00 acres and more than 25 acres respectively.

Kota (2011) revealed that slightly more than one-half (54.17 per cent) of the mango growers had ómediumô size of land holding i.e., (4.01 to 10.00 ha). The mango growers in the category of ólargeô size of land holding were (40.83 per cent) followed by ósemi-mediumô size of land holding (5.00 per cent).

Surve (2012) observed that 53.85 per cent of the respondents had size of land holding between ó4.01 to 10.00 haô, 30.77 per cent of them had size of land holding between ó2.01 to 4.00 haô followed by 9.23 per cent and 5.38 per cent of land between ó1.01 to 2.00 haô and ó10.00 ha and aboveô respectively. Only 0.77 per cent of the respondents had size of land holding óup to 1.00 haô.

Tekale and Gavit (2013) found that 40.00 per cent of the respondents were belonged to ómediumô (4.01 to 10 ha) land holding category followed by ósmallô (2.01 to 4.00 ha) land holders (37.00 per cent).

2.1.3.2. Area under Mango Cultivation

Misal (2002) reported that half (50.00 per cent) of the respondents were having ómediumô area under Alphonso mango (1.92 to 4.94 ha), while 31.00 per cent of the respondents were having ósmallô area under Alphonso mango (up to 1.41 ha) and 19.00 per cent of the respondents were having ólargeô area under Alphonso mango (above 4.95 ha). On an average the respondents had 3.18 ha area under Alphonso mango.

Khanolkar (2004) observed that maximum number (75.00 per cent) of the respondents had ómediumô size of orchard of mango and cashew (2.28 to 6.35 ha), while 13.00 per cent of the respondents had ósmallô area under mango and cashew orchard (up to 2.27 ha) and 12.00 per cent of the respondents had ólargeô size of orchard of mango and cashew (above 6.36 ha). On an average, the respondents had 4.31 ha of area under mango and cashew orchard.

Kadam (2006) noted that majority (46.11 per cent) of the respondents had ómediumô area under Alphonso mango cultivation, whereas 28.50 per cent and 15.03 per cent of the respondents had ósemi-mediumô and ómarginalô area under Alphonso mango plantation. Only 6.21 per cent and 4.15 per cent of the respondents had ólargeô and ósmallô area under Alphonso mango cultivation respectively.

Godse (2010) found that maximum number (34.67 per cent) of the respondents were having ósemi-mediumô area under mango cultivation, whereas, 32.00 per cent and 20.67 per cent of the respondents were having ósmallô and ómediumô area under mango cultivation respectively. Only 8.00 per cent and 4.66 per cent of the respondents were having ómarginalô and ólargeô area under mango cultivation respectively. The

average area under mango cultivation was 3.90 ha, indicating semi-medium area under mango cultivation.

Kota (2011) revealed that less than two-third (62.50 per cent) of the mango growers had ómediumô area in mango cultivation i.e. 5 to 13 ha and 22.50 per cent of them had ólowô area (up to 4 ha) and 15.00 per cent of them had óhighô area (14 ha and above) in mango cultivation.

Surve (2012) observed that 46.15 per cent of the respondents had pomegranate cultivation on an area of 2.51 ha and above, while 36.92 per cent and 16.92 per cent of them had pomegranate cultivation on 1.01 to 2.5 ha and up to 1.00 ha area respectively.

2.1.4 Annual Income

2.1.4.1 Total Annual Income

Katkar (2001) reported that majority (69.33 per cent) of the mango growers had ómediumô level of annual income followed by óhighô level (16.00 per cent) and ólowô level (14.67 per cent) of annual income.

Misal (2002) found that majority (61.00 per cent) of the respondents had ómediumô annual income, 23.00 per cent and 16.00 per cent of the respondents had ólowô and óhighô annual income respectively.

Khanolkar (2004) revealed that majority of the mango and cashew growers had ómediumô annual income.

Thippeswamy (2007) indicated that 68.75 per cent of the respondents had an annual income between ` 49, 310 to ` 1, 21, 217 followed by income more than ` 1, 21, 217 (18.13 per cent) and only 13.13 per cent of them had annual income below ` 49, 310.43 .

Godse (2010) revealed that maximum number (44.66 per cent) of the respondents had ómediumô annual income, while 36.67 per cent respondents had ólowô annual income and 18.67 per cent respondents had óhighô annual income.

Kanwat (2011) reported that majority (73.33 per cent) of the respondents had ómediumô annual income i.e. ` 68,590- 1,61,820, while 20.83 per cent and 17.50 per cent of the respondents had ólowô i.e. less than ` 68,590 and óhighô i.e. more than ` 1,61,820 annual income respectively.

Kota (2011) revealed that three-fourth (75.00 per cent) of the mango growers were having ómediumô annual income i.e. ` 3,85,712 to ` 9,08,056, while 13.33 per cent and 11.67 per cent of the mango growers had óhighô and ólowô annual income respectively.

Surve (2012) found that 36.15 per cent of the respondents had an annual income between ` 2,00,001 to ` 4,00,000, while 30.77 per cent and 20.00 per cent of them had annual income between ` 1,00,001 to ` 2,00,000 and ` 4, 00, 001 and above respectively. About 13.08 per cent of respondents had annual income up to ` 1,00,000.

Tekale and Gavit (2013) observed that majority of the respondents (63.00 per cent) had their annual income above ` 2,00,000, while 21.00 per cent of them had annual income in range of ` 1,50,000 to ` 2,00,000.

2.1.4.2 Income Generated through Mango Production

Kalra *et al.* reported that majority (59.09 per cent) of the respondents had income ranging from ` 10,000 to ` 60,000 through peach cultivation followed by income range of ` 60,000 to ` 1,10,000 (16.36 per cent) and ` 1,10,000 to ` 1,60,000 (12.73 per cent), while 11.82 per cent of them had no income yet through peach cultivation.

Banerjee (2011) observed thet the annual net income earned per hectare was higher (` 55,024 /ha) in Alphonso mango than Kesar mango (` 44,773 /ha) during tender age. During adult period Kesar mango earned higher net income at ` 67,993 / ha than Alphonso mango (` 53, 698/ha). Net income accrued by Fazli variety of mango in Malda district, West Bengal was ` 2,96,000 per hectare, followed by Langra at `2,81,500, Himsagar at ` 1,87,500/ha and Laxmanbhog (` 1,20,000/ ha).

2.1.5 Sources of Information

Khanolkar (2004) revealed that majority of the mango and cashew growers had ómediumô mass media exposure.

Mohamed (2004) reported that main sources of information for mango farmers were friends and neighbours, extension personnel and agricultural cooperative director.

Phuse *et al.* (2007) noted that majority (20.50 per cent) of the respondents ranked first to the progressive farmers in the villages as source of information followed by plant protection dealers (16.50 per cent), Agricultural Extension Officers (11.50 per cent), newspaper release (10.50 per cent), television (9.50 per cent), village level workers (8.50 per

cent), radio broad casting (6.00 per cent), neighbours (5.50 per cent), friends (4.50 per cent), progressive farmers from other village and books or magazines 3.50 per cent and 3.50 per cent respectively.

Thippeswamy (2007) observed that more than 48.00 per cent of respondents were regular reader of the newspaper. It is also observed that 66.87 per cent of the respondents were regular listeners of radio. Similarly, only 9.37 per cent of the respondents were habit of listening agriculture programme (Krishi ranga) moreover as high as 71.87 per cent of the respondents were never listening to the agriculture programmes broadcasted through radio. Majority (70.63 per cent) of the farmers were never read the farm magazines. Similarly, it is observed that 61.87 and 34.37 per cent of the respondents were viewing television regularly.

Jadhav (2009) found that more than one third of the mango growers (38.67 per cent) had ómediumô mass media participation and nearly one third of them (32.67 per cent) belonged to ólowô mass media participation category whereas, 28.67 per cent of them belonged to óhighô mass media participation category.

Sonawane *et al.* (2009) indicated that majority (46.00 per cent) of the respondents had ómediumô sources of information followed by ólowô (32.67 per cent) and óhighô (21.33 per cent) level of information sources.

Belarmino *et al.* (2011) noted that mango growers relied on own knowledge and chemical companies for technical information.

Jadhav *et al.* (2011) revealed that for information on plant protection majority of the mango growers had linkage with private companies (78.00 per cent) followed by fellow farmers (45.33 per cent) and UAS scientists (43.33 per cent). None of the mango growers had linkage with department of horticulture, APEDA/ NHB/ Hopcoms and

growers association whereas, for procurement of the inputs like nutrients and plant protection chemicals cent per cent of farmers had linkage with input dealers.

Kota (2011) reported that three- fourth (75.00 per cent) of the mango growers were having ómediumô information sources, while 13.33 per cent and 11.67 per cent of the respondents were having ólowô and óhighô information sources respectively.

Surve (2012) found that 52.31 per cent of the respondents had used ómediumô sources of information, while 26.15 per cent and 21.54 per cent of them had used ólowô and óhighô sources of information respectively.

Ugese *et al.* (2012) revealed that greatest source of information on improved mango fruit production within the locality is the farmers themselves followed by extension agent and then radio. Newspaper and bulletin were not found to be of any assistance in this regard.

Tekale and Gavit (2013) reported that in case of personal contact, majority of the respondents (62.00 per cent) had always contact with their friends regarding information about orange cultivation followed by always contact with neighbours and progressive farmers (59.00 per cent), while 56.00 per cent of them had always contact with relatives followed by sometime contact (37.00 per cent). The majority of respondents (55.00 per cent) had always contact with gram panchayat members and majority of respondents (63.00 per cent) were never contact by personal letters.

2.1.6 Extension Contact

Misal (2002) revealed that 46.00 per cent of the respondents had óhighô extension contact, while 34.00 per cent and 20.00 per cent of the respondents had ómediumô and ónoô extension contact, repectively.

Mohamed (2004) found that agricultural extension system offer its services to a limited mango farmers (33.75 per cent) by holding extension meetings, distributing pamphlets and transferring new experiences.

Khanolkar (2004) reported that majority of the mango and cashew growers had ómediumô extension contact.

Thippeswamy (2007) observed that majority 88.00 per cent, 90.60 per cent, 81.30 per cent, 74.40 per cent, 97.00 per cent, 80.00 per cent and 76.90 per cent of the respondents had never participated in demonstrations, extension meetings, field days, field trips, campaign, exhibition and krishimelas respectively.

Jadhav (2009) found that with respect to respondentsô extension participation, 46.00 per cent of the mango growers had ómediumô level of extension participation, while 32.00 and 22.00 per cent of them had óighô and ólowô levels of extension participation respectively. He also indicated that the extension activities like krishi mela, group discussion and agricultural exhibitions were regularly attended by 60.00, 50.00 and 20.00 per cent of the mango growers. As high as, 80.00 per cent and 72.67 per cent of the mango growers, had never attended the educational tours and training programme respectively. More than half of the respondents occasionally participated in demonstrations (53.33 per cent).

Kota (2011) indicated that less than three-fourth (72.50 per cent) of mango growers had ómediumô extension contact followed by ólowô (15.83 per cent) and óighô (11.67 per cent) extension contact respectively.

Surve (2012) reported that 61.54 per cent of the respondents had ómediumô extension contact, while 25.38 per cent and 13.08 per cent of them had ólowô and óighô extension contact respectively.

2.1.7 Use of Plant Protection Equipments

Gnanachandran and Sivayoganathan (1989) reported that about 81.00 per cent of the farmers used knapsack sprayers with various tank capacities ranging from 2.0 gallons to 5.0 gallons. Only 2.78 per cent of the farmers possessed power sprayers, while 16.11 per cent of the farmers were using a double piston hand sprayers where a clay pot is used instead of a plastic or brass tank.

Khanolkar (2004) noted that the adoption of plant protection equipments by the mango and cashew growers was found at ómediumô level.

Thippeswamy (2007) revealed that more than 31.87 per cent of the respondents possessed the sprayer and none of them had possessed either dusters or any other plant protection equipments for the use.

Lastimoza (2008) found that 37.50 per cent of the mango growers were using knapsack sprayer.

Chowdhury and Ray (2010) noted that a high percentage of the respondents i.e. 76.67 per cent of the farmers had their own sprayers, whereas 08.00 per cent of the farmers had their own dusters.

Godse (2010) revealed that for the spraying of pesticides, 31.33 per cent respondents had power sprayer + gator sprayer, followed by 28.67 per cent of the respondents used gator sprayers. Good amount of power sprayers were used by the mango growers that is 16.67 per cent had power sprayer, 10.67 per cent had foot sprayer + gator sprayer, 5.34 per cent had power sprayer + foot sprayer and 3.33 per cent had power sprayer + marut sprayer+ gator sprayer, whereas 1.33 per cent each had power sprayer + foot sprayer + marut sprayer, foot sprayer and power

sprayer + marut sprayer. Out of 150 respondents 84 (56.00 per cent) respondents had power sprayer.

2.2 Extent of knowledge of mango growers regarding plant protection measures.

Zagade *et al.* (2000) found that the majority (54.50 per cent) of the respondents had ómediumô level of knowledge about recommended crop protection measures of cashew, while 23.50 per cent and 22.00 per cent of the respondents had ólowô and óhighô levels of knowledge respectively.

Katkar (2001) stated that majority (70.00 per cent) of the mango growers had ómediumô level of knowledge regarding mango production technology.

Khanolkar (2004) revealed that majority of the mango and cashew growers had ómediumô knowledge about plant protection equipments.

Mohamed (2004) found that there was a high knowledge need for the majority of the mango farmers for recommendation related to one cultivation practice which was disease and pest management.

Thippeswamy (2007) observed that the maximum of 61.88 per cent of coconut growing farmers had ómediumô knowledge level about cultivation and plant protection measures. He also observed that the hundred percent of farmers had of absolute knowledge about mites infestation. Similarly, 97.50 per cent of the farmers also had absolute knowledge about bud rot disease.

Jadhav (2009) revealed that 96.67 per cent of the mango growers were having correct knowledge about major pests and their control measures and 92.67 per cent of them were having knowledge about major diseases and their control measures.

Sonawane *et al.* (2009) reported that majority (48.00 per cent) of the respondents had ómediumô knowledge regarding improved strawberry

production technology, while 28.00 per cent and 24.00 per cent of them had ‘high’ and ‘low’ knowledge respectively.

Godse (2010) observed that majority (80.00 per cent) of the respondents had ‘medium’ level of knowledge regarding plant protection, while 11.33 per cent and 8.67 per cent of the respondents had ‘high’ and ‘low’ level of knowledge respectively

Modi *et al.* (2010) reported that a very less percentage of the mango growers had knowledge about chemical to avoid pathogen infection (15.83per cent), symptoms of anthracnose infection (16.67per cent), mode of infection of stem end rot disease (20.67 per cent), diseases which appears after slicing the fruit (20.00 per cent), characteristics of jelly seed (11.67 per cent), countries restricted importing of mango fruits due to infection of fruit fly (4.17per cent), symptoms of spongy tissue (23.33per cent), mango variety susceptible to spongy tissue (84.17per cent) and use of convectional heat leads to spongy tissue (21.67per cent).

Jadhav and Manjunath (2011) observed that 39.33 per cent of the mango growers belonged to ‘medium’ level of knowledge about the recommended practices of mango cultivation whereas, 34.00 per cent and 26.00 per cent of the mango growers belonged to the ‘high’ and ‘low’ knowledge levels respectively.

Kanwat *et al.* (2011) reported that 98.33 per cent of the respondents had knowledge regarding insect pests and diseases of orange and their control measures.

Kawale *et al.* (2011) revealed that majority (79.00 per cent) of the respondents had ‘medium’ knowledge level about recommended mango cultivation practices, while 15.00 per cent and 6.00 per cent had ‘low’ and ‘high’ knowledge level respectively.

Kota (2011) revealed that large majority (99.17 per cent) of mango growers had knowledge on identification and symptoms of damage of mango hoppers followed by thrips (87.50 per cent), fruit borer (70.83 per cent) and leaf webber (51.67 per cent), termites (44.17 per cent). When comes to their management practices, control measures for mango hopper was known to (91.66 per cent) of mango growers followed by thirps (87.50 per cent), fruit borer (65.00 per cent), leaf webber (50.00 per cent) and termites (33.33 per cent). He also revealed that identification and symptoms of damage of anthracnose were known to **(**85.00 per cent) of mango growers followed by sooty mould (80.00 per cent) and powdery mildew (26.67 per cent). In case of management practices, (79.16 per cent) of mango growers had knowledge on control measures for anthracnose followed by sooty mould (78.33 per cent) and powdery mildew (26.67 per cent). Overall 76.49 per cent and 63.89 per cent of the respondents had knowledge about integrated pest management and integrated disease management respectively.

Mehta and Sonawane (2012) observed that majority (72.00 per cent) of the mongo growers had medium knowledge of improved mango cultivation technology.

Surve (2012) indicated that half (50.00 per cent) of farmers had partial knowledge about application of copper oxychloride 15g + carbaryl 6 g + DDVP 3 ml + sticker 1 ml per litre water on main stem, while large majority (73.85 per cent) of the farmers had complete knowledge about first spraying of 1 % Bordeaux mixture immediately after pruning. As well as about half (45.38 per cent) of pomegranate farmers had partial knowledge about second spraying of streptocyclin 250 ppm + copper oxychloride 0.25 % + non ionic sticker 10 days after first spraying. Large number (66.92 per cent) of farmers had partial knowledge about third

spraying of 0.4 % Bordeaux mixture 10 days after second spraying. He also observed that more than half (55.38 per cent) of farmers had partial knowledge about Fourth spraying of streptocyclin 250 ppm + cabendazim 0.1% 10 days after third spraying, while more than half (53.08 per cent) of farmers had no knowledge of further spray given if necessary as second, third and fourth spray.

2.3 Adoption level of plant protection measures followed by the mango growers.

Sharma *et al.* (1999) observed that adoption of plant protection measures for the mango was poor among mango growers. The respondents who had adopted chemicals method for the control of insect pests were in the range of 20.00 to 42.86 per cent and those who had used against diseases in mango were 16.67 to 43.75 per cent. The percentages of the respondents who had applied the recommended doses of insecticides, ranged from 40.00 to 45.00 per cent whereas those who had applied the recommended doses of fungicides were 60.00 to 64.28 per cent.

Zagade *et al.* (2000) found that in the case of adoption of recommended crop protection measures, the majority (54.00 per cent) of the respondents had ómediumô adoption level, while 29.50 per cent of the respondents had no adoption. Only 10.50 and 6.00 per cent of the respondents had óhighô and ólowô adoption levels respectively.

Katkar (2001) reported that 68.67 per cent of the mango growers had ómediumô level of adoption of recommended cultivation practices, while 17.33 per cent of them had óhighô level of adoption followed by ólowô level of adoption (14.00 per cent).

Hassan *et al.* (2002) indicated that majority of the mango growers (96.00 per cent) were adopting practice of destruction of diseased plants or plant parts of the mango.

Manvar *et al.* (2003) revealed that none of the mango farmers had a ôhighô adoption level in the case of fertilizer use, plant protection and method of inducing regular bearing.

Mohamed (2004) found that there was a high implementing need for the majority of the mango farmers for recommendation related to four cultivation practice which were packing, disease and pest control, fruits grading and grafting.

Moulasab *et al*. (2005) revealed that for majority (86.66 per cent) of the mango growers had noticed the pest mango hopper and applied chemicals like carbaryl, monocrotophos, sulphur, endosulphan once or more than once for its control. None of the respondents had adopted recommended plant protection measures to control pests. In case of diseases, 58.33 per cent of the mango growers had noticed the disease powdery mildew and applied chemicals like sulphur and dithane M- 45 once or more than once for its control.

Mirani (2007) indicated that in adoption of Male Annihilation Technique for control fruit flies, 16.70 per cent of the farmers were following recommended number of traps per acre, 30.00 per cent of them following recommended height of trap, all the farmers (100.00 per cent) were adopting recommended colour of trap, 98.30 per cent of them were preparing recommended solution, while practices like cleaning of traps and dispose off killed flies were followed by 30.00 per cent and 60.00 per cent of the farmers respectively.

Phuse *et al.* (2007) stated that for controlling various pest majority (44.00 per cent) of the respondents had ópartialô adoption of plant protection measures and for controlling serious diseases majority (43.50 per cent) of the respondents also had ópartialô adoption of plant protection measures.

Thippeswamy (2007) revealed that about 58.76 per cent of farmers had adopted plant protection measures to control pests and diseases. He also found that about 27.00 per cent of farmers revealed ócompleteô adoption of plant protection measures to control mites infestation followed by ócompleteô adoption to control bud rot disease (28.00 per cent).

Wagale *et al.* (2007) observed that 76.67 per cent mango growers were using plant protection chemicals.

Lastimoza (2008) reported that 90.00 per cent of the mango growers were spraying chemicals for controlling fruit fly followed by pest waya waya (71.87 per cent), seed borer (43.75 per cent), aphids (15.62 per cent) and tip borers (06.25 per cent).

Mahadik *et al.* (2008) indicated that that a large majority (85.45 per cent) of mango growers had ómediumô extent of adoption of recommended mango cultivation technologies, while only 12.73 per cent and 1.82 per cent of them had óhighô and ólowô extent of adoption respectively.

Sumathi and Rathakrishnan (2008) indicated that among the big farmers very limited persons had used growth regulators and pest and disease control (below 20.00 per cent) and in case of the small farmers, growth regulators and pest and disease control measures were not at all

followed. This study also revealed that plant protection aspects were observed to be negligible in adoption.

Godse (2010) revealed that more than three-fourth (78.00 per cent) of the respondents had ómediumô adoption level regarding plant protection practices, while 12.00 per cent of the respondents had ólowô and remaining 10.00 per cent of the respondents had óighô overall adoption level.

Modi *et al.* (2010) revealed that majority (69.16 per cent) of the farmers did not adopted chemical method of control of storage pest and diseases, majority (79.17 per cent) of the farmers were not using recommended concentration and doses of chemicals and most of them (66.67 per cent) were not following proper time of application of chemicals.

Singh *et al.* (2010) found that in case of insect and pest, 48.00 per cent of mango growers were adopting plant protection measures, while 52.00 per cent of them were not at all adopting any plant protection measures in their mango orchards. He also found that in case of diseases, 47.00 per cent of mango growers were adopting plant protection measures, while 53.00 per cent of them were not at all adopting any plant protection measures in their mango orchards.

Sonawane *et al.* (2010) reported that 86.67 per cent of the respondents had adopted pest control measures and 42.00 per cent of them had adopted disease control measures.

Kawale *et al.* (2011) revealed that in case of adoption of recommended six sprays for blossom protection , majority (83.00 per cent) of the respondents had ófullyô adopted first spray, while majority (46.00 per cent), (55.00 per cent), (45.00 per cent) and (47.00 per cent) of

the respondents had ónot adoptedô second, third, fourth and fifth spray respectively. In case of sixth spray majority (50.00 per cent) of the respondents had ófullyô adopted the sixth spray. They also revealed that the other practices like using *Rakshak* trap for controlling fruit fly and spray of urea 2-10 gm and 20 ppm of auxins at 15 days interval to prevent fruit drop at pea size mango fruit were ónot adoptedô by 39.00 per cent and 73.00 per cent of the respondents respectively. Majority (72.00 per cent) of the respondents had ófullyô adopted use of Amar loranthus cutter.

Kota (2011) revealed that control measures for mango hopper was completely adopted by (90.83 per cent) of mango growers followed by thrips (87.50 per cent), fruit borer (50.00 per cent), termites (33.33 per cent) and leaf webber (10.00 per cent). This study also revealed that control measures for anthracnose was completely adopted by (75.00 per cent) of mango growers followed by sooty mould (73.33 per cent) and powdery mildew (26.67 per cent). Overall 59.16 per cent and 61.11 per cent of the respondents adopted integrated pest management and integrated disease management respectively.

Singh *et al.* (2011) found that adoption regarding plant protection measures was 51.25 per cent and 62.49 per cent among tribal and non-tribal mango growers respectively.

Surve (2012) revealed that in case of management of oily spot diesese in pomegranate, majority (41.53 per cent) of farmers had ónoô adoption and 40.00 per cent had ópartialô adoption about application of copper oxychloride 15g + carbaryl 6 g + DDVP 3 ml + sticker 1 ml per litre of water on main stem, while majority (56.92 per cent) of farmers had ócompleteô adoption of first spraying of 1 % Bordeaux mixture immediately after pruning. At the same time majority (44.61 per cent) of

pomegranate farmers had ópartialô adoption and 36.15 per cent had ócompleteô adoption of second spraying of streptocyclin 250 ppm + copper oxychloride 0.25 % + non ionic sticker 10 days after first spraying, while maximum number (53.07 per cent) of farmers had ópartialô adoption of third spraying of 0.4 % Bordeaux mixture 10 days after second spraying. He also revealed that majority (44.61 per cent) of farmers had ópartialô adoption of fourth spraying of Streptocyclin 250 ppm + Cabendazim 0.1% 10 days after third spraying, while more than half (70.00 per cent) of farmers had ónoô adoption of further spray to be given if necessary as second, third and fourth spray.

Ugese *et al.* (2012) revealed that most of the farmers (60.00 per cent) had not controlled pests on their farms at all, while some (40.00 per cent) had used insecticides or pesticides for controlling pests.

Imaita (2013) reported that 43.00 per cent of the growers adopted the innovations and 57.00 per cent did not adopt the innovations, while 62.00 per cent of trader or exporter adopted innovations and 38.00 per cent did not adopt innovations.

2.4 Constraints faced by the mango growers in adoption of plant protection measures

Misal (2002) observed that the constraints faced by mango growers in adoption of paclobutrazol technology were óhigh cost of paclobutrazolô (80.00 per cent) followed by óoccurrence of heavy fruit dropô (60.00 per cent) and ólack of technical information about paclobutrazol applicationô (53.00 per cent).

Kavaskar and Govind (2003) revealed that fixation of the price by commission agents (93.33 per cent) was the major constraint faced by the respondents followed by high cost of labour (90.00 per cent), fluctuation

in market price (89.16 per cent), lack of knowledge about peats and disease management (86.66 per cent), non existence of institutional market (80.83 per cent), lack of technical guidance (78.33 per cent), inadequate credit facilities (74.33 per cent), lack of timely supply of inputs (70.83 per cent), high cost of inputs (70.04 per cent), heavy damage by wind (68.35 per cent), inadequate irrigation facilities (60.83 per cent), non- availability of quality suckers (45.83 per cent).

Khanolkar (2004) stated that the major constraints faced by the mango and cashew growers were ‘high cost of plant protection equipments (72.00 per cent), ‘repair facility of plant protection equipments is not available at village level’ (71.00 per cent), ‘lack of technical knowledge’ (70.00 per cent) and ‘lack of proper technical guidance’ (70.00 per cent).

Mohamed (2004) concluded that high cost of fertilizers, pesticides and packaging, high transportation cost, dealers black mail and infestation by fungal diseases were important problems faced the mango farmers.

Kulhal (2004) reported that major constraints faced by the respondents were insufficient irrigation sources, high rates of labour wages, credit from co- operatives are not available in time, lack of knowledge about post harvest technology, lack of knowledge about canker control measures, lack of knowledge about pest and disease control measures and higher charges by commission agents.

Dhakane (2005) indicated that major constraints faced by considerable number of the farmers were lack of practical knowledge regarding control measures of insect pest and diseases, lack of technical knowledge about doses of fertilizers, high cost of insecticides and

pesticides, unavailability of cold storage facilities nearby the locality, high cost of manures and fertilizers and market rates are not known in time.

Singh (2005) revealed that the major constraints faced by the mango growers in adoption of placlobutrazol technology were high cost of paclobutrazol (78.18 per cent) followed by occurrence of heavy fruit drop (71.82 per cent), increased dose of manures and fertilizers (56.36 per cent) and lack of technical information about paclobutrazol application (53.00 per cent).

Raut (2006) found that in case of plant protection measures, ôhigh cost of plant protection chemicalsô was the major constraint faced by the 67.77 per cent of the respondents followed by ôlack of knowledge about plant protection chemicalsô (40.00 per cent), non- availability of sprayers in peak timeô (35.55 per cent) and ódifficulty in spraying the chemicals on the top oprtion of the treeô (32.22 per cent).

Mahadik *et al.* (2008) observed that ôlack of technical information about plant protection measuresô (70.91 per cent) was the major constraint, followed by ôhigh wage rates of labourersô (63.64 per cent), ôlack of skilled labourersô (60.00 per cent) and ôhigh cost of pesticides and fungicidesô (59.09 per cent) in adoption of recommended mango cultivation technologies. ôLack of finance at the time of specific operationô (35.45 per cent), ólack of irrigation facilitiesô (20.00 per cent) and óequipments are costlyô (19.09 per cent) were the other constraints faced by the mango growers.

Sumathi and Rathakrishnan (2008) noticed that inadequate market facility was the major constraint as reported by more than three-fourth of (81.66 per cent) the respondents followed by high transport cost (67.50

per cent), lack of transport facilities (63.33 per cent), lack of technical guidance (56.66 per cent), non-availability of credit facilities (54.16 per cent), failure of seasonal rains (51.66 per cent), high cost of pesticides (46.66 per cent), price fluctuation (35.00 per cent), high cost of labour (30.00 per cent) and non-availability of quality seedlings (10.00 per cent).

Jadhav (2009) found that high cost of grafts, fertilizers, chemicals (96.67 per cent each) and high cost of manures (96.00 per cent), high cost of labour (92.00 per cent) and lack of skilled labour (92.00 per cent), inadequate guidance regarding recommended technology (62.00 per cent), lack of knowledge about pest and disease management (58.00 per cent), low price for produce expressed and high transplantation cost (98.00 per cent each) were the different constraints expressed by the farmers in adoption of recommended cultivation practices of mango.

Gitonga *et al.* (2010) stated that most of the farmers (92.20 per cent) had problems of pests in their mango trees. The most common pests were the mango seed weevil (48.10 per cent), fruit fly (36.40 per cent), thrips (1.30 per cent), aphids 1.30 per cent and the most common diseases were the powdery mildew (46.80 per cent), anthracnose (18.20 per cent) and scab (2.60 per cent).

Godse (2010) found that major constraint faced by the respondents were ónon availability of skilled labourers for sprayingô (79.33 per cent) followed by ólack of knowledge regarding control measures used against pests and diseases like mite, stem borer, midge fly and diebackô (67.33 per cent), ódifficulty in identification of the pests and diseasesô (45.33 per cent). The other constraints faced by them were ólack of knowledge on damage of pests and diseasesô (17.33 per cent), ólack of knowledge regarding quantity of chemicals to be usedô (12.66 per cent), ónon

availability of required pesticidesô and óshortage of capitalô (each 12.00 per cent), ódosses due to wild animalô (10.00 per cent) and ódack of technical informationô (7.33 per cent).

Yadav *et al.* (2010) observed the eight major constraints of mango orchardists observed were lack of awareness regarding improved mango cultivation techniques (91.48 per cent), unavailability of scientific formation at proper time (80.32 per cent), lack of money (78.19 per cent), export facilities (77.66 per cent), poor marketing channel (73.94 per cent), testing laboratories are not available (70.64 per cent), unavailability of qualitative critical inputs at proper time (65.96 per cent) and more risk involved (64.75 per cent).

Kota (2011) revealed that inadequate and untimely availability of loans for mango cultivation (32.50 per cent) as their major constraint followed by unavailability of information material in local language i.e. Telugu (29.17 per cent), low knowledge and skill in identification of pests and diseases (26.67 per cent), high cost of fertilizers, pesticides, fungicides and bio-pesticides (25.83 per cent), unavailability of pest and disease resistant improved seedlings and grafts (25.00 per cent).

Surve (2012) observed that 100.00 per cent farmers face the problem of unavailability of continuous supply of electricity, while 88.46 per cent farmer face problem of more cost of plant protection measures and fertilizers, 83.85 per cent farmers face the problem of transportation cost is more and 82.31 per cent of farmers face problem of high rates of inputs. He also observed that majority (80.00 per cent) of farmers have faced the problem about fluctuations in the prices of fruits, 79.23 per cent farmers face the problem of more cost of packaging of fruits, while maximum number (75.38 per cent) of farmers face the problem of high

commission charges. Other major problems faced by the farmers were lack of timely availability of fertilizers in the market (72.31 per cent), very high cost of spraying equipment (70.77 per cent), lack of knowledge and skill of identification of disease (60.77 per cent), unavailability of skilled labour (55.38 per cent) and lack of knowledge about treatment of diseases of fruit crops (47.69 per cent).

Thorat *et al.* (2012) revealed that the major constraints faced by farmers were in the order of non availability of proper marketing channel, fertilizers were costly, non availability of required grafts in time, lack of knowledge about *Rakshak* trap, insecticides were costly, lack of knowledge about Amar loranthus cutter and water resources at far distance.

Ugese *et al.* (2012) revealed that major problems encountered by mango producers were pests and disease incidence and high perishability of produce. Inadequate farm labour, low price and poor yield were also mentioned at low extent.

Aski *et al.* (2013) stated that 63.33 per cent mango respondents of Hulakoti KVK and 70.00 per cent mango respondents of Hanumanamatti KVK expressed major constraint as expensive nature of plant protection chemicals.

Imaita (2013) revealed that lack of training and lack of organizations and institutions support were hindrance in innovation adoption in mango supply chain.

2.5 Suggestions of the mango growers to overcome the constraints in adoption of plant protection measures

Sharma *et al.* (1999) reported that the extension officers working at the grassroots level should educate the growers for use of plant protection measures, e.g. through farmers' days, short-term training courses on mango, on the spot guidance etc. Some type of horticultural plant clinic or diagnostic centre at the block level is also required.

Misal (2002) observed that major suggestions of the mango growers were paclobutrazol cost should be reduced (80.00 per cent) and technical information should be given through method demonstration of paclobutrazol application at village level (53.00 per cent).

Khanolkar (2004) stated that the major suggestions made by the mango and cashew growers were ócost of plant protection should be reducedô (75.00 per cent), órepair facility should be made available at village levelô (71.00 per cent), óplant protection equipment should not require much technical knowledgeô (70.00 per cent) and óspare parts should be available at village levelô (68.00 per cent).

Singh (2005) found that the important suggestions made by the mango growers were paclobutrazol cost should be reduced (78. 18 per cent), research should be carried out to minimize fruit drop (71. 82 per cent), fertilizers should be made available at subsidiary rate (56.36 per cent) and technical information should be given by experts by method demonstration of paclobutrazol application at village level (52.73 per cent).

Mahadik *et al.* (2008) reported that considering the remunerative value of mango in market, it is suggested to execute an intensive technology transfer programme in the mango growing areas, supported by

development of trained human resource. The concerned government organizations and non government organizations may take in consideration the constraints faced by the mango growers and adopt suitable strategy to overcome these constraints. Subsidies on equipments, pesticides and fungicides to be given by the government to increase adoption level of technology among the mango growers.

Sumathi and Rathakrishnan (2008) revealed that intensive, speedy and organised efforts of the extension functionaries, especially in horticulture is required. Field demonstrations, field visits, imparting technical knowledge through seminars, symposium, brain storming etc., are to be attempted to gain knowledge by the growers and gain conviction on the technologies which will enable them to follow the recommendations without any deviation. Mango based preservation and processing industries may be established in the district either by government or through potential groups with the financial aid from NABARD or Nationalised banks. This would help to solve the major constraints.

Godse (2010) revealed that the maximum (46.67 per cent) number of the respondents suggested that ‘all pesticides may be made available at subsidized rate’, whereas 43.33 per cent of the respondents suggested *Rakshak* fruit fly trap and methyl eugenol may be made available at every pesticide shop’. The other important suggestions were ‘information on recommended pesticides may be displayed at public places’ (33.33 per cent) followed by the ‘effective pesticides should be recommended immediately for the control of thrips’ (18.00 per cent), ‘frequent training should be organized to mango growers on identification of the pests and their management’ (13.33 per cent), ‘outbreak situation may be forecasted regularly in newspapers and local television channels’ (8.67

per cent). The suggestions namely ófoolproof package of practices of organic mango cultivation may be developedô, óseparate spray schedule may be recommended for Eurepgap certificationô and óinformation on pre harvest interval should be made available as it is required for export of mangoô were offered by 4.00 per cent, 2.66 per cent and 2.00 per cent of the respondents respectively.

Yadav *et al.* (2010) indicated that organization of short duration training courses at time to time, maximum demonstrations on different aspects for increasing knowledge of the mango orchardists, supply of critical agricultural inputs at proper time, assistance of financial support through different banking organization, providing post harvest technology and marketing information, and sufficient facilities to the mango orchardists are suggested as suitable strategies for promotion of quality mango production.

Belarmino *et al.* (2011) reported that to address the problems of the mango producers, the agenda proposed for actions focused on accelerating technology dissemination, organization of mango participants, off season production and research on pest control. The proposed agenda should be jointly implemented by the private sector and government agencies.

Surve (2012) revealed that all the (100.00 per cent) pomegranate growers had suggested the continuous supply of electricity, 89.23 per cent of farmers suggested extending facility of crop insurance for pomegranate orchard, 71.54 per cent of farmers suggested that cooperative organization should be established for marketing and 70.00 per cent of farmers suggested for providing subsidy for chemical fertilizers and plant protection measures. He also observed that farmers suggested other points

like control on commission agents (54.62 per cent), government should provide soil testing and water testing facility at village and tehsil level (53.85 per cent), training should be conducted at village and tehsil level by scientist (53.08 per cent) and oily spot disease resistant varieties of pomegranate should be made available (45.38 per cent).

Ugese *et al.* (2012) revealed that scientific improvements are required in areas such as spacing, fertilization, irrigation, pests and disease control, fruit harvest and introduction or popularization of varieties with high export potential. He also revealed that performance of extension needs to be upgraded.

Aski *et al.* (2013) observed that 56.66 per cent of mango respondents of KVK Hulakoti and 60.00 per cent of Hanumanamatti KVK suggested that cost of the plant protection chemicals should be reduced.

Imaita (2013) concluded that there is need to establish good linkages between farmers and research development systems which offer training on new technologies or innovations as well as assisting farmers in accessing markets for their products.

3. METHODOLOGY

This chapter deals with the methods and techniques used in conducting the present study. Scientific study of any problem requires an investigation to adopt appropriate methods and procedures in order to arrive at a fruitful conclusion. A methodology indicating ôWhereô and ôHowô the study was carried out. Details of methodology are given under the following major heads.

3.1 Locale of the study

3.1.1 Geography

3.1.1.1 Geographical location

3.1.1.2 Area and population

3.1.1.3 Soil of selected area

3.1.1.4 Climate

3.1.1.4.1 Rainfall

3.1.1.4.2 Temperature

3.1.2 Land utilization pattern

3.1.3 Cropping pattern

3.1.4 Irrigation

3.1.5 Transport, communication facilities and industries

3.2 Research design

3.3 Sampling

3.3.1 Selection of tehsils

3.3.2 Selection of mango growers

3.4 Instruments and methods used for data collection

3.4.1 Development of interview schedule

3.1 Locale of the study

The present study was conducted in Kolhapur district of Maharashtra state. Chandgad and Gadhinglaj tehsils were selected as locale of the study.

3.1.1 Geography

3.1.1.1 Geographical Location

Kolhapur district is located on south- west plateau of Maharashtra state and situated at 15° 17ô northern latitude and 73° 74ô eastern longitude. On eastern side of Kolhapur district there is Sangli district and Sindhudurg and Ratnagiri districts are situated on western side. Karnataka state boundary is adjacent to southern side.

3.1.1.2 Area and population

Total area of Kolhapur district is 7,68,500 ha which contributes to about 2.5 per cent of total area of Maharashtra state (Census 2011 Report). There are twelve tehsils in Kolhapur district *viz.* Ajara, Bhudhargad, Chandgad, Gadhinglaj, Gaganbavda, Hatkanangale, Kagal,

Karveer, Panhala, Radhanagari, Shahuwadi and Shirol. There are 1216 villages and 13 cities in Kolhapur district.

In 2011, Kolhapur district had a population of 38,76,001 members, of which males and females were 19,80,658 and 18,95,343 respectively. Kolhapur district population constituted about 3.45 per cent of total Maharashtra state population. With regard to sex ratio in Kolhapur district, it was 957 females per 1000 males. Average literacy rate of Kolhapur district in 2011 was 81.51 per cent (2011 Census Report).

3.1.1.3 Soil of selected area

Physiologically, Kolhapur district is divided into three broad soil zones shallow lateritic soil (17,240 ha), deep brownish soil (15,150 ha) and medium deep black soil (10, 290 ha).

Chandgad tehsil which belongs to the western part of district is covered with shallow lateritic soils (*tambad mati*), whereas Gadhinglaj tehsil which is the part of dry eastern zone is covered with medium black soil (*madhyam* or *bhari kali mati*). (NBSS & LUP, Nagpur)

3.1.1.4 Climate

3.1.1.4.1 Rainfall

Due to the Sahyadri mountain ranges along the western side of the district, Kolhapur district receives more rainfall in the western part than the rest of the district. In the year 2011-12, total average annual rainfall received in the district was 2130 mm. In Gaganbawda tehsil highest rainfall was recorded i.e. 7077 mm, while the lowest rainfall was recorded in Shirol tehsil i.e. 272 mm. The total rainfall recorded in the year 2011- 12 in Chandgad tehsil was 3277 mm, while in Gadhingaj tehsil it was 1012 mm.

3.1.1.4.2 Temperature

Average maximum temperature of Kolhapur district lies between 28^0C -35^0C and average minimum temperature lies between 14^0C -19^0C.

3.1.2 Land utilization pattern

The land utilization pattern of Kolhapur district is given in Table 1.

Table 1: Land utilization pattern of the Kolhapur district

Sr. No.	Land utilization pattern		Area ('000 ha)
1	Geographical area		768.5
2	Cultivable area		427.0
3	Forest area		147.2
4	Land under non agricultural use		36.4
5	Permanent pastures		41.6
6	Cultivable wasteland		36.4
7	Irrigated area		
	a	Net irrigated area	128.0
	B	Gross irrigated area	135.0
8	Rainfed area		298.9
9	Land under misc. tree crops and groves		6.4
10	Barren and uncultivable land		44.1
11	Current fallows		12.6
12	Other fallows		24.6

Source: Agricultural Statistical Information, Maharashtra State, 2006.

3.1.3 Cropping pattern

The field crops of Kolhapur district are rice, finger millet, *Kharif* sorghum, *Rabi* sorghum, maize, wheat, sugarcane, chickpea, groundnut and soybean. The major area comes under rice, finger millet, sugarcane and oilseeds like groundnut and soybean.

In case of horticultural crops, cashew is major plantation crop in Kolhapur district. Mango is the important fruit crop grown in this district, while sapota, banana and grape are also grown to some extent. Vegetables and spices are also grown in this area.

The information related to area under various crops grown in Kolhapur district is given in Table 2.

Table 2: Area under various crops in Kolhapur district

Sr. No.	Crop	Area ('000ha)
A	**Field crops**	
1	Sugarcane	113.9
2	Rice (Paddy)	113.8
3	Finger Millet	23.3
4	*Kharif* Sorghum	8.7
5	*Rabi* Sorghum	12.7
6	Maize	10.2
7	Wheat	9.6
B	**Pulses**	
1	Chickpea	10.1
C	**Oilseeds**	
1	Groundnut	57.4
2	Soybean	57.3
D	**Fruits**	
1	Mango	15.6
2	Sapota	2.0
3	Banana	0.5
4	Grape	0.05
E	**Vegetables**	
1	Cauliflower	2.3
2	Tomato	1.7
3	Cabbage	0.6
4	Potato	0.6
5	Onion	0.5
F	**Spices**	
1	Chilli	3.2

2	Turmeric	0.9
G	**Plantation crops**	
1	Cashew	16.8
2	Coconut	0.7

Source: Kolhapur District Superintending Agricultural Officer Reports 2008-09

3.1.4 Irrigation

The net irrigated area of Kolhapur district is 1,28,000 ha which is about 26.00 per cent of net sown area i.e. 4,76,916 ha. About 74,000 ha area is irrigated through lift irrigation and it contributes 57.80 per cent of the net irrigated of the district. Second important source of irrigation is open well which covers 29.10 per cent of net irrigated area (37,300 ha). Other sources of irrigation are bore wells and tanks which cover 4,200 ha and 3,700 ha net irrigated area respectively.

3.1.5 Transport, communication facilities and industries

Chandgad and Gadhinglaj tehsils are connected to Kolhapur district headquarter as well as to Goa and Karnataka states with road transport and communication networks like post, telephones etc.

The geographical location of Chandgad and Gadhinglaj tehsils is strategically important for industrial development but still the industrial development of both tehsils is slow due to lack of adequate initiative from government, co-operatives and private sectors.

Chandgad and Gadhinglaj are leading mango and cashew producing telsils in Kolhapur district. So there is a very good scope for development of mango and cashew on commercial basis. This will encourage the establishment of processing units in case of both mango

and cashew, as well as there is tremendous scope for industrial development in other sectors like dairies, poultries and sugar industries.

3.2 Research design

When the study moves from present to future, basing the interpretations of the happenings or the facts that have already occurred, the design employed is known as ex-post-facto design (Bhatnagar, 1981). Therefore the ex-post-facto research design was used for the present study.

3.3 Sampling

3.3.1 Selection of tehsils

Two tehsils *viz*., Chandgad and Gandhinglaj which are having highest area under mango cultivation in Kolhapur district were selected. Area under mango cultivation in different tehsils of Kolhapur district is presented in following Table 3.

Table 3: Area under mango cultivation in tehsils of Kolhapur district

Sr. No.	Name of the Tehsil	Area under Mango Cultivation (ha)
1	Shahuwadi	112
2	Panhala	532
3	Hatkanangale	426
4	Shirol	273
5	Karveer	347
6	Gaganbavada	186
7	Radhanagari	184
8	Kagal	530
9	Bhudargad	325
10	Ajara	309
11	Gadhinglaj *	708
12	Chandgad *	1604

* Selected tehsils for the study

Source: Socio- economic Review of Kolhapur District 2012

3.3.2 Selection of the respondents

List of the mango growers from each tehsil was obtained from respective Tehsil Agriculture Officer and then 105 respondents were selected purposively considering conveyance and objectives of the study.

3.4 Instruments and methods used for data collection

3.4.1 Development of the interview schedule

Keeping in view the objectives of study, an interview schedule was designed in the local language i.e. *Marathi.* The first part of the schedule consisted questions for getting information regarding independent variables *viz*. age, education, size of land holding, area under mango cultivation, annual income, income generated through mango production, sources of information, extension contact and use of plant protection equipments.

The second part of the interview schedule consisted of dependent variables *viz.* knowledge and adoption. The appropriate questions regarding knowledge and adoption of different plant protection measures against various pests and diseases of mango were included in the interview schedule.

3.4.2 Pre-testing of interview schedule

Before finalizing the interview schedule, it was pre-tested outside the sample area for reliability and validity of the questions by interviewing ten respondents.

The interview schedule was modified in the light of the practical experience of pre-testing and it was finally used for data collection.

3.4.3 Procedure for data collection

For obtaining maximum accuracy in data collection, rapport was established with mango growers and tried to win their confidence. The purpose of the study was explained to them and they were assured that the information furnished by them would be kept confidential and used strictly for the purpose of the study.

The data were collected by personally interviewing 105 mango growers according to interview schedule.

3.5 Variables and their Measurement

3.5.1 Independent Variables

3.5.1.1 Age

It refers to the chronological age of the mango growers at the time of interview. The mango growers were classified into three categories as follows;

Sr. No.	Age Group	Years
1.	Young	Up to 35 years
2.	Middle	36 to 55 years
3.	Old	56 years and above

3.5.1.2 Education

It is the level of formal education completed by an individual. According to formal education, the mango growers were classified into six categories as follows;

Sr. No.	Education	Standard
1.	Illiterate	No formal education
2.	Primary Education	1st to 7th std.
3.	Secondary and	8th to 10th std.
4.	Higher Secondary	11th and 12th std.
5.	Graduation level	Bachelorôs Degree
6.	Post graduation level	Masterôs Degree

3.5.1.3 Size of Land Holding

3.5.1.3.1 Total Land Holding

It refers to the total land owned by the mango growers. On the basis of land holding, the mango growers were grouped into five categories.

Sr. No.	Land Holding	Area
1.	Marginal	Up to 1.00 ha
2.	Small	1.01 to 2.00 ha
3.	Semi- medium	2.01 to 4.00 ha
4.	Medium	4.01 to 6.00 ha
5.	Large	6.01 ha and above

3.5.1.3.2 Area under Mango Cultivation

It is the total area under mango cultivation. According to this, mango growers were classified into three categories as follows;

Sr. No.	Land Holding	Area
1.	Small	Up to 1.00 ha
2.	Medium	1.01 to 2.50 ha
3.	Large	2.51 ha and above

3.5.1.4 Annual Income

3.5.1.4.1 Total Annual Income

It is gross annual income, of mango growers from different sources during preceding year. On the basis of annual income the mango growers were grouped into following categories.

Sr. No.	Annual Income
1.	Up to ` 1,00,000
2.	` 1,00,001- ` 2,00,000
3.	` 2,00,001- ` 4,00,000
4.	` 4,00,001 and above

3.5.1.4.2 Annual Income through Mango Production

It is the total income of the mango growers generated through mango production which is categorized as follows by using mean and standard deviation (Mean ± S.D).

Sr. No.	Category	Income
1.	Low	Up to ` 11, 942
2.	Medium	` 11, 943- ` 87, 199

3.	High	` 87, 200 and above

3.5.1.5 Sources of Information

It is operationally defined as the degree of informal, formal and mass media sources used by mango grower for seeking information and guidance about recommended plant protection measures. All possible resources were listed and responses were collected on 3 point continuum i.e. always, sometimes and never. Score 2, 1, 0 were given for their responses respectively. Thus the total score obtained, accordingly the mango growers were grouped into three categories by using mean and standard deviation (Mean ± S.D) as shown below.

Sr. No.	Category	Score
1.	Low	Up to 11
2.	Medium	12- 21
3.	High	22 and above

3.5.1.6 Extension Contact

It refers to contact of mango growers with various extension agencies for information and guidance about recommended plant protection measures.

The frequency of visits or contacts to extension personnel and organizations like Agricultural University, Village Extension Worker, Extension Officer, and Agriculture Officer etc. were considered. All possible resources were listed and responses were collected on 3 point continuum i.e. always, sometimes and never. Score 2, 1, 0 were given for their responses respectively. Thus the total score obtained, accordingly the mango growers were grouped into three categories by using mean and standard deviation (Mean ± S.D) as shown follows;

Sr. No.	Category	Score
1.	Low	Up to 4
2.	Medium	5- 9
3.	High	10 and above

3.5.1.7 Use of Plant Protection Measures

It refers to the type of plant protection equipments possessed and used by the mango growers. The categories of the respondents regarding use of plant protection equipments are given below.

Sr. No.	Use of Plant Protection Equipments
1.	Power Sprayer
2.	Pedal Sprayer
3.	Knapsack Sprayer
4.	Power Sprayer + Pedal Sprayer + Knapsack Sprayer
5.	Power Sprayer + Pedal Sprayer
6.	Power Sprayer + Knapsack Sprayer
7.	Pedal Sprayer + Knapsack Sprayer

3.5.2 Dependent Variables

3.5.2.1 Knowledge

It refers to awareness of mango growers regarding recommended plant protection measures.

The extent of knowledge of mango growers regarding plant protection measures was measured by scoring technique. For assessment of knowledge regarding plant protection measures, recommended practices were selected. Score 2, 1, 0 were assigned for complete knowledge, partial knowledge and no knowledge respectively about plant protection aspects. The overall knowledge of mango growers was worked

out. They were grouped into three categories by using statistical functions i.e. mean and standard deviation (Mean ± S.D) as given below.

Sr. No.	Category	Score
1.	Low	Up to 5
2.	Medium	5- 18
3.	High	19 and above

3.5.2.2 Adoption

It refers to a decision of the individual mango grower to make full use of recommended plant protection measures. For assessment of adoption regarding plant protection measures, recommended practices for control of pests *viz.,* mango hopper, thrips, fruit fly, stem borer, shoot borer, mealy bug and termites and diseases *viz.,* die-back, powdery mildew and fruit rot, while disorders *viz.,* fruit drop and alternate bearing were selected.

The level of adoption of mango growers regarding plant protection measures was measured by scoring technique. Score 2, 1, 0 were assigned for complete, partial and no adoption about plant protection aspects respectively. The total score was calculated and they were grouped into three categories by using statistical functions i.e. mean and standard deviation (Mean ± S.D) as follows;

Sr. No.	Category	Score
1.	Low	Up to 3
2.	Medium	4- 12
3.	High	13 and above

3.5.3 Constraints

It is a reason, cause or circumstance, which compels the mango growers in non-adoption or partial adoption of recommended plant protection measures. The information on the constraints experienced by the mango growers was collected. Responses about this aspect were recorded and respective percentages were worked out in order to draw conclusion.

3.5.4 Suggestions

Suggestions were secured from the mango growers to overcome the constraints experienced by them in adoption of recommended plant protection measures. The suggestions were grouped and percentages of suggestions were worked out.

3.6 Statistical tests

In this study the statistical methods such as frequencies, percentages, arithmetic mean and standard deviation were used for proper estimation of the values of the variables.

3.6.1 Frequency

Frequency is the number of items repeated in the selected variables.

3.6.2 Percentage

The data were subjected to percentages and used to distribute respondents according to selected variables. Percentage is the number, amount, rate etc. expressed as it is part of a total which is 100.

3.6.3 Arithmetic Mean

Arithmetic mean was calculated by using formula,

$$\bar{x} = \frac{\Sigma x}{N}$$

Where,

$\bar{x}$ = Arithmetic mean

Σx = Sum of the respondent score

N = Number of the respondents

3.6.4 Standard Deviation

Standard Deviation was calculated by using formula,

$$S.D = \sqrt{\frac{\Sigma (x-\bar{x})^2}{N}}$$

Where,

S.D = Standard Deviation

x = Score of each respondent

$\bar{x}$ = Arithmetic mean

N = Number of the respondents

3.7 Operational Definitions

Different terms used in the present study are explained below.

3.7.1 Independent Variables

1. **Age:** It is defined as chronological age (in years) of the mango grower at the time of interview.

2. **Education:** The term education referred to the formal education completed by mango grower from primary to degree level.

3. **Size of land holding:** It refers to the total area owned by the mango grower.

4. **Area under mango cultivation:** It refers to the area possessed by the mango grower under mango cultivation.

5. **Annual income:** It is the total income of all family members generated by all sources in a year.

6. **Income generated through mango production:** It is total income of mango grower generated through mango production in a year.

7. **Sources of information:** It is operationally defined as the degree of informal, formal and mass media sources used by mango grower for seeking information and guidance about recommended plant protection measures.

8. **Extension contact:** It refers to contact of mango grower with various extension agencies for getting information and guidance about recommended plant protection measures.

9. **Use of plant protection equipments:** It refers to the type of plant protection equipments possessed and used by the mango grower.

3.7.2 Dependent Variables

1. **Knowledge:** It is operationally defined as awareness of mango grower regarding recommended plant protection measures.

2. **Adoption:** It is operationally defined as decision of the individual mango grower to make full use of recommended plant protection measures.

4. RESULTS AND DISCUSSION

This chapter deals with the presentation, analysis and interpretation of data and assessment of result. The collected data were compiled through the primary and secondary tables in view of the objectives of the study.

Subsequently the data were subjected to appropriate statistical tests. Simple frequencies and percent were worked out for descriptive analysis. The data are presented in tabular forms with respective graphs.

The results of the research study are presented and discussed in the following headings and sequence.

4.1 Profile of the mango growers.

4.2 Extent of knowledge of mango growers regarding plant protection measures.

4.3 Adoption level of plant protection measures followed by the mango growers.

4.4 Constraints in adoption of plant protection measures followed by the mango growers.

4.5 Suggestions made by the mango growers about plant protection measures.

4.1 Profile of the mango growers

4.1.1 Age

The data about the chronological age of the mango growers were collected, complied and presented in Table 4.

Table 4: Distribution of mango growers according to their age group

Sr. No.	Age (Years)	Respondents (n= 105)	
		Number	Percent
1	Young (Up to 35 Years)	8	7.62
2	**Middle (36 to 55 Years)**	**63**	**60.00**
3	Old (56 and above)	34	32.38
	Total	105	100.00

An overview of Table 4 revealed that three- fifth (60.00 per cent) of the mango growers were belonged to ómiddleô age group, while less than one- third (32.38 per cent) and less than one- tenth (7.62 per cent) of the mango growers were belonged to óoldô age group and óyoungô age group respectively. The average age of the mango growers was 53.4 years.

Hassan *et al.* (2002), Jadhav (2009) and Kota (2011) had also found the similar pattern of age distribution amongst the respondents.

4.1.2 Education

The information regarding the formal education completed by the mango growers was collected and according to their education level they were grouped into six categories. The data regarding education level of the mango growers are presented in Table 5.

With respect of formal education level obtained, Table 5 depicted that majority (37.14 per cent) of the mango growers had education up to ósecondary levelô followed by óprimary levelô (26.67 per cent), óhigher secondary levelô (16.20 per cent) and ógraduation levelô (12.38 per cent), while only 1.90 per cent of them had education up to ópost graduation

Table 5: Distribution of mango growers according to their education level

Sr. No.	Education Level	Respondents (n= 105)	
		Number	Percent
1	Illiterate	6	5.71
2	Primary Level (1st to 7th std.)	28	26.67
3	**Secondary Level (8th to 10th)**	**39**	**37.14**
4	Higher Secondary Level (11th and 12th)	17	16.20
5	Graduation Level (Bachelorôs Degree)	13	12.38
6	Post Graduation Level (Masterôs Degree)	2	1.90
	Total	105	100

levelô. It also revealed that 5.71 per cent of the mango growers were óilliterateô. The average education level of the respondents was up to 8th standard.

The important reason contributing in the lower education level of the respondents might be the traditional environment in the villages; this prevented them from higher studies. The distance of higher study centres from the villages and need for more investment also might have acted as obstacles in their higher education.

4.1.3 Size of land holding

Size of land holding is discussed in two sub categories i.e. total land holding and area under mango cultivation as follows;

4.1.3.1 Total land holding

Distribution of the mango growers into five categories according to total land possessed by them is given in Table 6.

Table 6: Distribution of the mango growers according to their total land holding

Sr. No.	Size of Land Holding	Respondents n= 105	
		Number	Percent
1	Marginal (0.01 to 1.00 ha)	3	2.86
2	Small (1.01 to 2.00 ha)	32	30.48
3	**Semi- medium (2.01 to 4.00 ha)**	**42**	**40.00**
4	Medium (4.01 to 6.00 ha)	17	16.19
5	Large (6.01 and above)	11	10.47
	Total	105	100

It was observed from the data given in Table 6 that two- fifth (40.00 per cent) of the mango growers had ósemi- mediumô (2.01 to 4.00 ha) size of land holding, less than one- third (30.47 per cent) of them had ósmallô (1.01 to 2.00 ha) size of land holding, while less than one- fifth (16.19 per cent) of the mango growers had ómediumô (4.01 to 6.00 ha) size of land holding, whereas 10.47 per cent and only 2.86 per cent of them had ólargeô (6.01 ha and above) and ómarginalô (Up to 1.00 ha) size of land holding respectively.

It can be concluded that substantial proportion of the mango growers had ósemi- mediumô (2.01 to 4.00 ha) and ósmallô (1.01 to 2.00 ha) size of land holding, possible reason might be that the ancestor land was fragmented into smaller sized land holdings.

4.1.3.2 Area under mango cultivation

The mango growers were categorized on the basis of the area under mango. The distribution is given in Table 7.

Table 7: Distribution of the mango growers according area under mango cultivation

Sr. No.	Area Under Mango Cultivation	Respondents (n= 105)	
		Number	Percent
1	**Small (Up to 1.00 ha)**	**74**	**70.48**
2	Medium (1.01 to 2.5 ha)	25	23.81
3	Large (2.51ha and above)	6	5.71
	Total	105	100.00

The data given in Table 7 depicted that majority (70.48 per cent) of the mango growers had ósmallô area (Up to 1.00 ha) under mango cultivation, while 23.81 per cent of them had ómediumô area (1.01 to 2.5 ha) under mango cultivation. It also indicates that very less proportion i.e. 5.71 per cent of the mango growers had ólargeô area (2.51ha and above) under mango cultivation.

It can be concluded from Table 6 and Table 7 that as most of the mango growers were possessing ósemi- mediumô (2.01 to 4.00 ha) and ósmallô (1.01 to 2.00 ha) size of land holding hence, most of them brought ósmallô area (Up to 1.00 ha) under mango cultivation. Generally orchards were established on land unusable for cultivation of field crops. The next important reason might be late bearing of mango crop, which prevented the farmers from its cultivation.

4.1.4 Annual Income

Annual income is discussed in two sub categories i.e. total annual income and income generated through mango production as follows;

4.1.4.1 Total Annual Income

The data regarding total annual income of the mango growers were obtained. According to annual income they were grouped into four categories as given in Table 8.

Table 8: Distribution of the mango growers according to their annual income

Sr. No.	Annual Income	Respondents n = 105	
		Number	Percent
1	Up to ` 1,00,000	34	32.38
2	**` 1,00,001 to ` 2,00,000**	**44**	**41.90**
3	` 2,00,001to ` 4,00,000	14	13.33
4	` 4,00,001 and above	13	12.39
	Total	105	100.00

From the data mentioned in Table 8, it can be concluded that more than two- fifth (41.90 per cent) of the mango growers had annual income between ` 1,00,001 to ` 2,00,000 and less than one- third (32.38 per cent) of them had annual income up to ` 1,00,000, while annual income of 13.33 per cent of the mango growers ranged between ` 2,00,001 to ` 4,00,000 and annual income of 12.39 per cent of the respondents was ` 4,00,001 and above.

Majority of the mango growers had annual income between ` 1,00,001 to ` 2,00,000 and up to ` 1,00,001. It might be due to

possession of ósemi- mediumô and ósmallô sized land holding and cultivation of this land was the only source of their income.

4.1.4.2 Income Generated through Mango Production

According to income generated through mango production the respondents were distributed into three categories given below in Table 9.

Table 9: Distribution of the mango growers according to their income generated through mango production

Sr. No.	Income Generated through Mango Production	Respondents n = 105	
		Number	Percent
1	Low (Up to ` 11,942)	4	3.81
2	**Medium (` 11,943- ` 87,199)**	**87**	**82.86**
3	High (` 87,200 and above)	14	13.33
	Total	105	100.00

Mean: 49,571.43 **SD:** 37,628.72

According to Table 9 it can be depicted that most of the (82.86 per cent) mango growers were getting ómediumô income (` 11,943- ` 87,199) through mango production, while 13.33 per cent and 3.81 per cent of them were getting óhighô income (` 87,200 and above) and ólowô income (Up to ` 11,942) through mango production.

Income generated through mango production was poor, as orchards were being established on small area (up to 1.00 ha) just as secondary source of income with no business attitude of marketing quality produce by the majority of the mango growers.

4.1.5 Sources of Information

The data regarding the sources of information used by mango

growers were obtained and they were grouped into three categories given in Table 10.

Table 10: Distribution of the mango growers according to their sources of information

Sr. No.	Sources of Information (Score)	Respondents n = 105	
		Number	Percent
1	Low (Up to 11)	22	20.95
2	**Medium (12 - 21)**	**66**	**62.86**
3	High (22 and above)	17	16.19
	Total	105	100.00

Mean: 16.26 **SD:** 4.92

The data given in Table 10 mentioned that more than three- fifth (62.86 per cent) of the mango growers had ómediumô sources of information, while nearly one- fifth (20.95 per cent) and less than one-fifth16.19 per cent of them had ólowô and óighô sources of information respectively.

Television, the most popular mass media was possessed by nearly 95.00 per cent of the respondents. About more than half of them were watching agricultural programmes (*Annadata* and *Amachi Maati Amachi Maanas*) occasionally. The next most important source of information was news paper. Nearly two- third of the respondents used to read newspaper regularly, while only about one- fourth of them read agricultural newspaper (Agrowon) and magazines (*Shetkari, Baliraaja* etc.) occasionally. Individual information sources like family members, relatives, friends and progressive farmers from village were also effective among the respondents.

óMediumô exposure to the different information sources by the majority of the mango growers might be due to their average information seeking behaviour.

This finding is in conformity with the findings of Jadhav (2009), Kota (2011) and Surve (2012).

4.1.6 Extension Contact

The data regarding the extension contact were obtained and according to that mango growers were classified into three categories which are given in Table 11.

Table 11: Distribution of mango growers according to their extension contact

Sr. No.	Extension Contact (Score)	Respondents n = 105	
		Number	Percent
1	**Low (Up to 4)**	**47**	**44.76**
2	Medium (5 - 9)	36	34.29
3	High (10 and above)	22	20.95
	Total	105	100.00

Mean: 6.67 **SD:** 3.00

The data in Table 11 depicted that less than one- half (44.76 per cent) of the mango growers had ólowô level of extension contact, whereas less than one- third (34.29 per cent) of them had ómediumô extension contact and more than one- fifth (20.95 per cent) of them óhighô level of extension contact.

Majority of the mango growers had ólowô extension contact might be due to occasional linkage with only government extension personnel (Agricultural Assistants) and private extension personnel (Agro- input dealers).

4.1.7 Use of Plant Protection Equipments

The data regarding the use of plant protection equipments by the

mango growers were obtained. According to use of plant protection equipments they were categorised into seven categories.

The distribution of the mango growers according to use of plant protection equipments is given in Table 12.

Table 12: Distribution of mango growers according to use of plant protection equipments

Sr. No.	Use of Plant Protection Equipments	Respondents n= 105	
		Number	Percent
1	Power Sprayer	4	3.81
2	Pedal Sprayer	27	25.71
3	**Knapsack Sprayer**	**39**	**37.14**
4	Power Sprayer + Pedal Sprayer + Knapsack Sprayer	3	2.86
5	Power Sprayer + Pedal Sprayer	4	3.81
6	Power Sprayer + Knapsack Sprayer	2	1.90
7	Pedal Sprayer + Knapsack Sprayer	26	24.76
	Total	105	100.00

The data in Table 12 indicated that more than one- third (37.14 per cent) of the mango growers were using knapsack sprayer, while more than one- fourth (25.71 per cent) were using pedal sprayer and less than one- fourth (24.76 per cent) were using pedal sprayer + knapsack sprayer. Very less proportion of the mango growers were using power sprayer and power sprayer + pedal sprayer (3.81 per cent each), while only 2.86 per cent and 1.90 per cent of them were using power sprayer + pedal sprayer + knapsack sprayer and power sprayer + knapsack sprayer respectively.

It is observed that only those who were economically sound and who had large mango orchards possessed and used power sprayer. Due to high cost of power sprayer nearly one- fourth of the respondents possessed and use only pedal sprayer. The important reason behind possession of only knapsack sprayer by the more than one- third of the respondents might be negligence toward plant protection measures for control of mango pest and diseases hence, they did not possessed and used sprayers like pedal sprayers or power sprayers which are necessary for spraying in mango.

4.2 Extent of knowledge of the mango growers regarding plant protection measures

The data in respect of the knowledge level of the mango growers about the plant protection measures were collected and categorized on the basis of score obtained. The distribution of knowledge level of mango growers is given in Table 13.

Table 13: Distribution of the mango growers according to their knowledge level

Sr. No	Level of Knowledge (Score)	Respondents n=105	
		Number	Percent
1	Low (Up to 5)	20	19.05
2	**Medium (5-18)**	**69**	**65.71**
3	High (19 and above)	16	15.24
	Total	105	100

Mean: 11.56 **SD:** 6.73

The data mentioned in Table 13 revealed that less than two- third (65.71 per cent) of the mango growers had ómediumô level of knowledge

regarding plant protection measures, while less than one- fifth (19.05 per cent) of them had ólowô level of knowledge. Only 15.24 per cent of the mango growers had óhighô level of knowledge.

It is indicated that the knowledge level of the majority of the mango growers was medium which might be due to the fact that they had medium exposure to different sources of information and low extension contact. Education level of the respondents also might have influence on their overall knowledge level regarding recommended plant protection measures.

Zagade *et al.* (2000) and Kawale *et al.* (2011) had also found the similar results regarding knowledge level of the respondents.

4.2.1 Knowledge of the mango growers regarding plant protection measures for control of pests

Information pertaining to the knowledge of the mango growers regarding plant protection measures for control of pest is presented in Table 14.

The result pertaining to the knowledge of the mango growers regarding plant protection measures for control of pest is as follows;

4.2.1.1 Control of Mango Hoppers

For control of mango hoppers a six sprays schedule is recommended at different stages of mango, the data given in Table 14 indicated that, in case of control of mango hoppers, majority (69.52 per cent) of the mango growers had ónoô knowledge regarding the first spray of 3 ml cypermethrin 25 EC or 5 ml fenvalerate 20 EC or 9 ml decamethrin 2.8 EC in 10 litres of water at the end of September or first

Table 14: Knowledge of mango growers regarding plant protection measures for control of pests

Sr. No.	Recommended Plant Protection Measures for Control of Pests	Knowledge					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Mango Hoppers**						
A	Spraying Schedule						
I	First spray: At end of September or first week of October						
	Cypermethrin 25 EC (3ml) or Fenvalerate 20 EC (5 ml) or Decamethrin 2.8 EC (9 ml) mixed in 10 litres of water	14	13.34	18	17.14	73	69.52
II	Second spray: After bud burst stage						
	Quinalphos 25 EC (20 ml) in 10 litres of water	13	12.38	3	2.86	89	84.76
III	Third spray: Two weeks after second spray (at the flowering stage)						
	Imidacloprid 17.8 EC (3 ml) or Chlothianidin 50 WDG (1.2 g) mixed in 10 litres of water	25	23.81	16	15.24	64	60.95
IV	Fourth spray: Two weeks after third spray						
	Thiamethoxam 25 WG (1 g) mixed in 10 litres of water	3	2.86	6	5.71	96	91.43
V	Fifth spray: Two weeks after fourth spray						
	Phenthoate 50 EC (20 ml) or Dimethoate 30EC (10 ml) mixed in 10 litres of water	4	3.81	19	18.10	82	78.09
VI	Sixth spray: Two weeks after fifth spray						
	Any insecticide suggested in fifth spray which is not used	0	0	0	0	105	100.00

2	**Thrips**						
A	Spray of Spinosad 45 EC (2.5 ml) in 10 litres of water	2	1.90	4	3.81	99	94.29
B	Spray of Thiamethoxam 25 WG (2 g) in 10 litres of water if infestation of pest found to be sever	3	2.86	6	5.71	96	91.43
3	**Fruit Fly**						
A	Use of *Rakshak* Traps (4/ ha). Keep the traps hanging on the tree above 1-3m from ground and use of Methyl eugenol (3 ml/ trap) as fly attractant	0	0	6	5.71	99	94.29
4	**Stem Borer**						
A	Removal of grubs with iron hook	18	17.14	0	0	87	82.86
B	Injection of EDCT mixture or one Alluminium Phosphide (ALP) tablet in hole and seal the hole with mud	2	1.90	5	4.76	98	93.34
5	**Shoot Borer**						
A	Spray of Quinalphos 25 EC (20 ml) in 10 litres of water	13	12.38	3	2.86	89	84.76
6	**Mealy Bug**						
A	Mixing 100g of 2% methyl parathion dust per tree in soil	3	2.86	9	8.57	93	88.57
B	Spray of Chlorpyrifos 20 EC (20 ml) or Profenofos 50 EC (20 ml) and addition of 10 ml sticker or 25 g fish oil rosin soap in 10 litres of water	0	0	2	1.90	103	98.10
C	To prevent the nymph from climbing on trees, banding the tree trunks with 30 cm wide alkathene sheet (400 gauge) on 30 cm distance from ground level	0	0	9	8.57	96	91.43

7	**Termites**						
A	Complete destruction of termitarium and destruction of the queen	91	86.67	14	13.33	0	0
B	Spray of Chlorpyrifos 20 EC (5 ml) or Methyl parathion 50 EC (2 ml) per litre of water	12	11.43	4	3.81	89	84.76

week of October while, 17.14 per cent and 13.34 per cent of them had ópartialô and ócompleteô knowledge regarding first spray respectively.

In case of the second spray for control of mango hoppers, after bud burst stage with 20 ml quinalphos 25 EC in 10 litres of water, majority (84.76 per cent) had ónoô knowledge, while 12.38 per cent of them had ócompleteô knowledge and 2.86 per cent of them had ópartialô knowledge.

With respect to the third spray i.e. two weeks after second spray with 3 ml imidacloprid 17.8 EC or 1.2 g chlothianidin 50 WDG in 10 ml of water majority (60.95per cent) of the mango growers had ónoô knowledge, whereas 23.81 per cent and 15.24 per cent of them had ócompleteô and ópartialô knowledge respectively.

The fourth spray for control of mango hoppers which is scheduled two weeks after third spray i.e. spray of thiomethoxam 25 WG at the rate of 1g per 10 litres of water, majority (91.43 per cent) of the mango growers had ónoô knowledge, whereas only 5.71 per cent and only 2.86 per cent of them had ócompleteô and ópartialô knowledge about this practice respectively.

In case of the fifth spray, two weeks after fourth spray with 20 ml phenthoate 50 EC or 10 ml dimethoate 30 EC in 10 litres of water, majority (78.09 per cent) of the mango growers had ónoô knowledge, while 18.10 per cent of them had ópartialô knowledge and remaining 3.81 per cent of them had ócompleteô knowledge, where as with regard to sixth spray, not even single mango grower knew the practice of sixth spray.

4.2.1.2 Control of Thrips

In case of recommendation for control of thrips i.e. spraying 2.5 ml spinosad 45 EC in 10 litres of water, Table 14 depicted that majority (94.29 per cent) of the mango growers had ónoô knowledge, whereas only 3.81 per cent and 1.90 per cent of them had ópartialô and ócompleteô knowledge.

The second spray which is recommended for sever infestation of thrips i.e. spray of 2 g thiamethoxam 25 WG in 10 litres of water, majority (91.43 per cent) of them had ónoô knowledge, while 5.71 per cent and only 2.86 per cent of them had ópartialô and ócompleteô knowledge.

4.2.1.3 Control of Fruit Fly

For control fruit fly, which is one if the major pest of mango, recommended practice of installation of *Rakshak* trap (pheromone trap) at the rate of 4 traps per ha and use of methyl eugenol (3 ml/ trap) as fly attractant, majority (94.29 per cent) of the mango growers had ónoô knowledge, while only 5.71 per cent of them had ópartialô knowledge about this practice.

4.2.1.4 Control of Stem Borer

It is inferred from Table 14, that majority (82.86 per cent) of the mango growers had ónoô knowledge and 17.14 per cent had ócompleteô knowledge about mechanical method for control of stem borer i.e. removal of grubs from tree trunk with help of iron hook.

In case of chemical control i.e. injection of EDCT mixture or one alluminium phosphide (ALP) tablet in hole and sealing the hole with mud, majority of the mango growers (93.34 per cent) had ónoô knowledge

while, 4.76 per cent of them had ópartialô knowledge and only 1.90 per cent of them had ócompleteô knowledge.

4.2.1.5 Control of Shoot Borer

The data given in Table 14 indicated that with respect to control of shoot borer with spray of 20 ml quinalphos 25 EC in 10 litres of water, majority (84.76 per cent) of the mango growers had ónoô knowledge, while 12.38 per cent and only 2.86 per cent of them had ócomplete ôand ópartialô knowledge about it respectively.

4.2.1.6 Control of Mealy Bug

With respect to the recommended practice of mixing 100g of 2 per cent methyl parathion dust in soil under the tree, Table 14 indicated that majority (88.57 per cent) of the mango had ónoô knowledge, while 8.57 per cent of them had ópartialô knowledge and only 2.86 per cent of them had ócompleteô knowledge.

In case of spraying 20 ml chlorpyrifos 20 EC or 20 ml profenofos 50 EC and addition of sticker or 25 g fish oil rosin soap in 10 litres of water, the data in Table 14 revealed that majority (98.10 per cent) of the mango growers had ónoô knowledge, while 1.90 per cent of them had ópartialô knowledge.

Regarding the physical control i.e. banding the tree trunks with 30 cm wide and 400 gauge plastic sheet to prevent the nymphs from climbing on tree, majority (91.43 per cent) of the mango growers had ónoô knowledge and remaining 8.57 per cent of them had ópartialô knowledge.

4.2.1.7 Control of Termites

The data mentioned in Table 14 revealed that regarding control of termites i.e. complete destruction of whole termitarium as well as queen,

most of the (86.67 per cent) mango growers had complete knowledge and remaining 13.33 per cent of them had partial knowledge.

Majority (84.76 per cent) of the mango growers had ónoô knowledge regarding the recommendation of spraying 5 ml chlorpyrifos 20 EC or 2 ml methyl parathion 50 EC per litre of water against termites, while 11.43 per cent and 3.81 per cent of them had ócompleteô and ópartialô knowledge respectively.

4.2.2 Knowledge of the mango growers regarding plant protection measures for control of diseases

Information pertaining to the knowledge of the mango growers regarding plant protection measures for control of diseases is presented in Table 15.

The result pertaining to the knowledge of the mango growers regarding plant protection measures for control of diseases is as follows;

4.2.2.1 Control of Die- back

It is observed from Table 15 that in case of recommended control measures for die- back i.e. spraying 30 g copper oxychloride 50WP or 30 g mancozeb 80 WP in 10 litres of water or spraying 1% Bordeaux mixture, majority (63.81 per cent) of the mango growers had ónoô knowledge followed by ócompleteô (22.86 per cent) and ópartialô (13.33 per cent) knowledge.

Majority (83.81 per cent) of the mango growers had ónoô knowledge regarding cutting and burning of infected branches and applying Bordeaux paste on cut portion, while 10.48 per cent and 5.71 per cent of them had ópartialô and ócompleteô knowledge respectively.

Table 15: Knowledge of mango growers regarding plant protection measures for control of diseases

Sr. No.	Recommended Plant Protection Measures for Control of Diseases	Knowledge					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Die-back**						
A	Spray of Copper Oxychloride 50WP (30 g) or Mancozeb 80 WP(30 g) in 10 litres of water or Spray of 1% Bordeaux mixture	24	22.86	14	13.33	67	63.81
B	Cutting and burning of infected branches and application of Bordeaux paste on cut portion	6	5.71	11	10.48	88	83.81
2	**Anthracnose (On Leaves/ Inflorescence/ Fruits)**						
A	Spray of Carbendazim 50 WP (10 g) or Copper Oxychloride 50 WP (25 g) in 10 litres of water or Spray of 1% Bordeaux mixture on leaves, inflorescence and fruits	52	49.52	11	10.48	42	40.00
3	**Powdery Mildew (On Leaves/ Inflorescence)**						
A	Spray of Sulphur 80 WP (20 g) or Carbendazim 50 WP (10 g) or Hexaconazole 5 EC (5 g) or Thiophanate methyl 70 WP (10 g) or Propineb 70 WP (20 g) in 10 litres of water	55	52.38	9	8.57	41	39.05

4	**Fruit Rot**						
A	After harvesting dipping of fruits in 0.05% solution of Carbendazim for 10 mins	44	41.90	11	10.48	50	47.62
	Other						
1	**Loranthus**						
A	Cutting of loranthus from mango trees	57	54.29	29	27.62	19	18.09
B	Amar loranthus cutter for cutting loranthus	0	0	3	2.86	102	97.14
C	After cutting loranthus from tree, application of Butachlor 0.03% or Fluchlorlin 0.3% or Glyphosate 0.5% weedicide on infected area	0	0	0	0	105	100.00

Table 16: Knowledge of mango growers regarding plant protection measures for control of disorders

Sr. No.	Recommended Plant Protection Measures for Control of Mango Disorders	Knowledge					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Fruit Drop**						
A	Spraying of NAA 20 ppm Auxin at 15 days interval to prevent fruit drop of pea size mango fruit	56	53.33	10	9.53	39	37.14
2	**Alternate Bearing**						
A	Application of Paclobutrazol	3	2.86	0	0	102	97.14

4.2.2.2 Control of Anthracnose

Anthracnose is the one of the major disease of the mango which infects the different plant parts like leaves, inflorescence and fruits also. Table 15 indicated that with respect to the control measure of this disease i.e. spraying 10 g carbendazim 50 WP or 25 g copper oxychloride 50 WP in 10 litres of water on leaves, inflorescence and fruits, majority (49.52 per cent) of the mango growers had ócompleteô knowledge, while 40.00 per cent and 10.48 per cent of them had ónoô and ópartialô knowledge respectively.

4.2.2.3 Control of Powdery Mildew

Powdery Mildew is the most sever diseases of mango which causes more losses in the mango. According to Table 15, in case of recommended control measures for the control of powdery mildew disease i.e. spraying 20 g sulphur 80 WP or 10 g carbendazim 50 WP or 5 ml hexaconazole 5 EC or 10 g thiophanate methyl 70 WP or 20 g propineb 70 WP in 10 litres of water, majority (52.58 per cent) of the mango growers had ócompleteô knowledge, whereas 39.05 per cent of them had ónoô knowledge and remaining 8.57 per cent of them per cent of them had ópartialô knowledge.

4.2.2.4 Control of Fruit Rot

According to the data mentioned in Table 15 in case of post harvest control measures for control of fruit rot i.e. dipping mango fruits in 0.05 per cent solution of carbendazim 50 WP for 10 minutes, majority (47.62 per cent) of the mango growers had ónoô knowledge, while 41.90 per cent of them had ócompleteô knowledge and 10.48 per cent of them had ópartialô knowledge.

4.2.2.5 Other Parasites

4.2.2.5.1 Control of Loranthus

For control of loranthus which is ecto- parasite in the mango crop the data given in Table 15 revealed that majority (54.29 per cent) of the mango growers completely knew the practice of cutting loranthus properly, while 27.62 per cent and 18.09 per cent of them had ópartialô and ónoô knowledge respectively.

The data also revealed that 97.14 per cent of the mango growers had no knowledge about Amar loranthus cutter and only 2.86 per cent of them had ópartialô knowledge about it.

In case of chemical control of loranthus i.e. application of butachlor 0.03% or fluchlorlin 0.3% or glyphosate 0.5% weedicide on infected area, not even single farmer had knowledge about it.

4.2.3 Knowledge of the mango growers regarding plant protection measures for control of disorders

Information pertaining to the knowledge of the mango growers regarding plant protection measures for control of disorders is presented in Table 16.

The result pertaining to the knowledge of the mango growers regarding plant protection measures for control of disorders is as follows;

4.2.3.1 Fruit Drop

The data mentioned in Table 16 indicated that in case of control of mango disorder i.e. fruit drop of pea size mango fruits, majority (53.33 per cent) of the mango growers had ócompleteô knowledge of spraying NAA 20 ppm or auxin at 15 days interval, while 37.14 per cent of them

had ónoô knowledge and remaining 9.53 per cent of them had ópartialô knowledge.

4.2.3.2 Alternate Bearing

Alternate bearing is one of the major disorders in mango especially in Alphonso variety. According to Table 16, it can be concluded that majority 97.14 per cent of the mango growers had ónoô knowledge about paclobutrazol application to induce regular bearing in mango, while only 2.86 per cent of the mango growers had ócompleteô knowledge about this practice.

According to Table 14 and 15, it can be concluded that mango growers had more knowledge regarding recommended plant protection measures for control of diseases than knowledge regarding recommended plant protection measures for control of pests.

4.3 Adoption level of plant protection measures followed by the mango growers

The term adoption was operationally defined as continuous use of plant protection measures in mango.

Technique used for measurement of adoption has been explained in methodology. The adoption score of individual mango growers worked out and they were classified into three categories. The distribution is given in Table 17.

Table 17: Distribution of the mango growers according to their adoption level

Sr. No	Level of Adoption (Score)	Respondents n=105	
		Number	Percent
1	Low (Up to 3)	23	21.90
2	**Medium (4-12)**	**70**	**66.67**
3	High (13 and above)	12	11.43
	Total	105	100

Mean: 7.28 **SD:** 4.48

It is observed from table 17 that about majority (66.67 per cent) of the mango growers had ómediumô level of adoption regarding plant protection measures, while 21.90 per cent and 11.43 per cent of them had ólowô and óhighô level of adoption respectively.

The plausible reason for above findings could be attributed to the attitude of growers towards mango plantation. Generally orchards were planted on land unusable for cultivation of field crops just as secondary source of income with no business attitude of marketing quality produce hence, majority of the farmers were cultivating mango without any maintenance of orchards through proper cultivation practices especially plant protection measures.

The other important reason behind medium and low adoption of plant protection measures was medium and low level of knowledge.

Distribution pattern of the respondents according to extent of adoption of plant protection measures is similar with the findings of Godse (2010).

4.3.1 Adoption of the mango growers regarding plant protection measures for control of pests

Information pertaining to the adoption of the mango growers regarding plant protection measures for control of pest is presented in Table 18.

The result pertaining to the adoption of the mango growers regarding plant protection measures for control of pest is as follows;

4.3.1.1 Control of Mango Hoppers

For control of mango hoppers which cause severe loss of the mango crop, the data given in Table 18 indicated that majority (79.05 per cent) of the mango growers had ónoô adoption with respect to the first spray of 3 ml cypermethrin 25 EC or 5 ml fenvalerate 20 EC or 9 ml decamethrin 2.8 EC in 10 litres of water at the end of September or first week of October, while 17.14 per cent of them had ópartialô adoption and remaining 3.81 per cent of them had ócompleteô adoption.

In case of the second spray, after bud burst stage with 20 ml quinalphos 25 EC in 10 litres of water, majority (87.62 per cent) of the mango growers had ónoô adoption, whereas 10.48 per cent and 1.90 per cent of them had ópartialô and ócompleteô level of adoption respectively.

Regarding the third spray i.e. two weeks after second spray with 3 ml imidacloprid 17.8 EC or 1.2 g chlothianidin 50 WDG in 10 ml of water, 83.81 per cent of the mango growers had ónoô adoption, while 11.43 per cent and 4.76 per cent of them were partially and completely adopting this practice respectively.

The fourth spray for control of mango hoppers which is scheduled two weeks after third spray i.e. spray of thiomethoxam 25 WG at the rate

Table 18: Extent of adoption of mango growers regarding plant protection measures for control of pests

Sr. No.	Recommended Plant Protection Measures for Control of Pests	Adoption					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Mango Hoppers**						
A	Spraying Schedule						
I	First spray: At end of September or first week of October						
	Cypermethrin 25 EC (3ml) or Fenvalerate 20 EC (5 ml) or Decamethrin 2.8 EC (9 ml) mixed in 10 litres of water	4	3.81	18	17.14	83	79.05
II	Second spray: After bud burst stage						
	Quinalphos 25 EC (20 ml) in 10 litres of water	2	1.90	11	10.48	92	87.62
III	Third spray: Two weeks after second spray (at the flowering stage)						
	Imidacloprid 17.8 EC (3 ml) or Chlothianidin 50 WDG (1.2 g) mixed in 10 litres of water	5	4.76	12	11.43	88	83.81
IV	Fourth spray: Two weeks after third spray						
	Thiamethoxam 25 WG (1 g) mixed in 10 litres of water	0	0	0	0	105	100.00
V	Fifth spray: Two weeks after fourth spray						
	Phenthoate 50 EC (20 ml) or Dimethoate 30EC (10 ml) mixed in 10 litres of water	2	1.90	6	5.71	97	92.39
VI	Sixth spray: Two weeks after fifth spray						
	Any insecticide suggested in fifth spray which is not used	0	0	0	0	105	100.00

2	**Thrips**						
A	Spray of Spinosad 45 EC (2.5 ml) in 10 litres of water	0	0	2	1.90	103	98.10
B	Spray of Thiamethoxam 25 WG (2 g) in 10 litres of water if infestation of pest found to be sever	0	0	0	0	105	100.00
3	**Fruit Fly**						
A	Use of *Rakshak* Traps (4/ ha). Keep the traps hanging on the tree above 1-3m from ground and use of Methyl eugenol (3 ml/ trap) as fly attractant	0	0	0	0	105	100.00
4	**Stem Borer**						
A	Removal of grubs with iron hook	5	4.76	12	11.43	88	83.81
B	Injection of EDCT mixture or one Alluminium Phosphide (ALP) tablet in hole and seal the hole with mud	0	0	0	0	105	100.00
5	**Shoot Borer**						
A	Spray of Quinalphos 25 EC (20 ml) in 10 litres of water	2	1.90	11	10.48	92	87.62
6	**Mealy Bug**						
A	Mixing 100g of 2% methyl parathion dust per tree in soil	2	1.90	9	8.57	94	89.53
B	Spray of Chlorpyrifos 20 EC (20 ml) or Profenofos 50 EC (20 ml) and addition of 10 ml sticker or 25 g fish oil rosin soap in 10 ml of water	0	0	0	0	105	100.00
C	To prevent the nymph from climbing on trees, banding the tree trunks with 30 cm wide alkathene sheet (400 gauge) on 30 cm distance from groung level	0	0	3	2.86	102	97.14

7	**Termites**						
A	Complete destruction of termitarium and destruction of the queen	85	80.95	20	19.05	0	0
B	Spray of Chlorpyrifos 20 EC (5 ml) or Methyl parathion 50 EC (2 ml) per litre of water	3	2.86	13	12.38	89	84.76

of 1 g per 10 litres of water was not at all adopted by the mango growers.

In case of the fifth spray i.e. two weeks after fourth spray with 20 ml phenthoate 50 EC or 10 ml dimethoate 30 EC in 10 litres of water, majority (92.39 per cent) of the mango growers had ónoô adoption, while only 5.71 per cent of them had ópartialô adoption and remaining 1.90 per cent of them had ócompleteô adoption, whereas with regard to sixth spray, not even single mango grower was adopting the practice.

4.3.1.2 Control of Thrips

According to the data given in Table 18, it can be concluded that regarding recommended practice for control of thrips i.e. spraying 2.5 ml spinosad 45 EC in 10 litres of water, majority (98.10 per cent) of the mango growers had ónoô adoption and only 1.90 per cent of the had ópartialô adoption.

In case of the second spray, which is recommended for sever infestation of thrips i.e. spray of 2 g thiamethoxam 25 WG in 10 litres of water was not adopted by any of the mango grower.

4.3.1.3 Control of Fruit Fly

The data mentioned in Table 18 revealed that recommended practice for control of fruit flies i.e. installation of *Rakshak* trap (pheromone trap) at the rate of 4 traps per ha was not at all adopted by the mango growers.

4.3.1.4 Control of Stem Borer

It is inferred from Table 18 that majority (83.81per cent) of the mango growers had ónoô adoption about mechanical method for control of stem borer i.e. removal of grubs from tree trunk with help of iron hook,

while 11.43 per cent and 4.76 per cent of them had ópartialô and ócompleteô adoption.

With regard to chemical control i.e. injection EDCT mixture or one alluminium phosphide (ALP) tablet in hole and sealing the hole with mud was not at all adopted by any mango grower.

4.3.1.5 Control of Shoot Borer

According to Table 18 it can be depicted that for control of shoot borer majority (87.62 per cent) of the mango growers were not adopting recommended control measure i.e. spray of 20 ml quinalphos 25 EC in 10 litres of water, while 10.48 per cent of them were partially adopting the practice and remaining 1.90 per cent of them adopting the practice completely.

4.3.1.6 Control of Mealy Bug

With respect to the control of mealy bug, the data given in Table 18 indicated that majority 89.53 per cent of the mango had ónoô adoption regarding the recommended practice of mixing 100 g of 2 per cent methyl parathion dust in soil under the tree, while 8.57 per cent of them had ópartialô adoption about it and remaining 1.90 per cent of them had ócompleteô adoption.

The recommendation of spraying 20 ml chlorpyrifos 20 EC or 20 ml profenofos 50 EC and addition of sticker or 25 g fish oil rosin soap in 10 litres of water was not at all adopted by the mango growers.

Regarding physical control i.e. banding the tree trunks with 30 cm wide and 400 gauge plastic sheet to prevent the nymphs from climbing on tree, 97.14 per of the mango growers had ónoô adoption, while only 2.86 per cent of them were adopting the practice partially.

4.3.1.7 Control of Termites

The data mentioned in Table 18 revealed that regarding physical control of termites i.e. complete destruction of whole termitarium as well as queen, most of the (80.95 per cent) mango growers had ócompleteô adoption and remaining 19.05 per cent of them had ópartialô adoption.

With regard to the recommendation of spraying 5 ml chlorpyrifos 20 EC or 2 ml methyl parathion 50 EC per litre of water against termites, majority (84.76 per cent) of the mango growers had ónoô adoption, while 12.38 per cent and only 2.86 per cent of them had ópartialô and ócompleteô adoption.

4.3.2 Adoption of the mango growers regarding plant protection measures for control of diseases

Information pertaining to the knowledge of the mango growers regarding plant protection measures for control of diseases is presented in Table 15.

The result pertaining to the knowledge of the mango growers regarding plant protection measures for control of diseases is as follows;

4.3.2.1 Control of Die- back

The data given in Table 19 revealed that, in case of recommended control measures for die- back i.e. spraying 30 g copper oxychloride 50WP or 30 g mancozeb 80 WP in 10 litres of water or spraying 1% Bordeaux mixture, majority 71.43 per cent of the mango growers had ónoô adoption followed by ópartialô (17.14 per cent) and ócompleteô (11.43 per cent) adoption, whereas majority (93.33 per cent) of the mango growers had ónoô adoption regarding cutting and burning of infected branches and applying Bordeaux paste on cut portion, while 4.76 per cent

Table 19: Extent of adoption of mango growers regarding plant protection measures for control of diseases

Sr. No.	Recommended Plant Protection Measures for Control of Diseases	Adoption					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Die-back**						
A	Spray of Copper Oxychloride 50WP (30 g) or Mancozeb 80 WP(30 g) in 10 litres of water or Spray of 1% Bordeaux mixture	12	11.43	18	17.14	75	71.43
B	Cutting and burning of infected branches and application of Bordeaux paste on cut portion	2	1.91	5	4.76	98	93.33
2	**Anthracnose (On Leaves/ Inflorescence/ Fruits)**						
A	Spray of Carbendazim 50 WP (10 g) or Copper Oxychloride 50 WP (25 g) in 10 litres of water or Spray of 1% Bordeaux mixture on leaves, inflorescence and fruits	17	16.19	43	46.67	39	37.14
3	**Powdery Mildew (On Leaves/ Inflorescence)**						
A	Spray of Sulphur 80 WP (20 g) or Carbendazim 50 WP (10 g) or Hexaconazole 5 EC (5 g) or Thiophanate methyl 70 WP (10 g) Propineb 70 (20 g) WP in 10 litres of water	42	40.00	23	21.90	40	38.10

4	**Fruit Rot**						
A	After harvesting dipping of fruits in 0.05% solution of Carbendazim for 10 mins	6	5.72	27	25.71	72	68.57
	Other						
1	**Loranthus**						
A	Cutting of loranthus from mango trees	8	7.62	73	69.52	24	22.86
B	Amar loranthus cutter for cutting loranthus	0	0	0	0	105	100.00
C	After cutting loranthus from tree, application of Butachlor 0.03% or Fluchlorlin 0.3% or Glyphosate 0.5% weedicide on infected area	0	0	0	0	105	100.00

Table 20: Extent of adoption mango growers regarding plant protection measures for control of disorders

Sr. No.	Recommended Plant Protection Measures for Control of Mango Disorders	Adoption					
		Complete		Partial		No	
		Number	Percent	Number	Percent	Number	Percent
1	**Fruit Drop**						
A	Spraying of NAA 20 ppm Auxin at 15 days interval to prevent fruit drop of pea size mango fruit	18	17.14	47	44.76	40	38.10
2	**Alternate Bearing**						
A	Application of Paclobutrazol	0	0	3	2.86	102	97.14

and 1.91 per cent of them had ópartialô and ócompleteô adoption respectively.

4.3.2.2 Control of Anthracnose

With respect to the control measures of anthracnose disease i.e. spraying 10 g carbendazim 50 WP or 25 g copper oxychloride 50 WP in 10 litres of water on leaves, inflorescence and fruits, the data given in Table 19 depicted that majority (46.67 per cent) of the mango growers had ópartialô adoption, while 37.14 per cent and 16.19 per cent of them had ónoô and ócompleteô adoption respectively.

4.3.2.3 Control of Powdery Mildew

In case of control measures for the control of powdery mildew disease which are spraying 20 g sulphur 80 WP or 10 g carbendazim 50 WP or 5 ml hexaconazole 5 EC or 10 g thiophanate methyl 70 WP or 20 g propineb 70 WP in 10 litres of water, it is observed from Table 19, that majority (40.00 per cent) of the mango growers had ócomplete óadoption whereas, 38.10 per cent of them had ónoô adoption and 21.90 per cent of them had ópartialô adoption about the control measures.

4.3.2.4 Control of Fruit Rot

It is observed from Table 19 that, in case of post harvest control measures for control of fruit rot i.e. dipping mango fruits in 0.05 per cent solution of carbendazim 50 WP for 10 minutes, majority (68.57 per cent) of the mango growers had ónoô adoption, while 25.71 per cent of them had ópartialô adoption and 5.72 per cent of them had ócompleteô adoption.

4.3.2.5 Other Parasites

4.3.2.5.1 Control of Loranthus

In case of control of loranthus which is ecto- parasite in the mango crop majority (69.52 per cent) of the mango growers were partially adopting the practice of cutting loranthus properly, while 22.86 per cent and 7.62 per cent of them had ónoô and ópartialô adoption respectively.

The data also revealed that no any farmer was adopting Amar loranthus cutter and chemical control of loranthus i.e. application of butachlor 0.03% or fluchlorlin 0.3% or glyphosate 0.5% weedicide on infected area.

4.3.3 Adoption of the mango growers regarding plant protection measures for control of disorders

Information pertaining to the knowledge of the mango growers regarding plant protection measures for control of disorders is presented in Table 16.

The result pertaining to the knowledge of the mango growers regarding plant protection measures for control of disorders is as follows;

4.3.3.1 Fruit Drop

The data mentioned in Table 20 revealed that, in case of control of mango disorder i.e. fruit drop of pea size mango fruits, majority (44.76 per cent) of the mango growers were partially adopting the practice of spraying NAA 20 ppm or Auxin at 15 days interval while, 38.10 per cent of them were not adopting and remaining 17.14 per cent of them were completely adopting the practice of controlling fruit drop.

4.3.3.2 Alternate Bearing

According to Table 20 it can be concluded that majority 97.14 per cent of the mango growers had ónoô adoption about paclobutrazol application to induce regular bearing in mango, while only 2.86 per cent of the mango growers had ópartialô adoption about it.

According to Table 14, 15, 18 and 19 it can be concluded that as mango growers had more level of knowledge regarding recommended plant protection measures for control of diseases than level of knowledge regarding recommended plant protection measures for control of pests hence, extent of adoption of regarding recommended plant protection measures for control of diseases also tends to be more than extent of adoption regarding recommended plant protection measures for control of pests.

4.4 Constraints faced by the mango growers in adoption of recommended plant protection measures

The efforts were made to understand the constraints faced by the mango growers in adoption of the recommended plant protection measures of mango. The details of constraints are given in Table 21.

The data mentioned in Table 21 revealed that the regarding knowledge of the plant protection measures, major constraints faced by the mango growers were ólack of technical and scientific guidance regarding plant protection measuresô (90.48 per cent), ólack of knowledge regarding quantity and concentrations of chemicals to be usedô (84.76 per cent), whereas ólack of knowledge regarding identification of pests, their nature of damage, diseases and their symptomsô was also important constraint faced by 78.10 per cent of the respondents.

Table 21: Constraints faced by the mango growers in adoption of recommended plant protection measures

Sr. No.	Constraints	Respondents n = 105	
		Number	Percent
I	**Constraints regarding knowledge of plant protection measures**		
1	Lack of technical and scientific guidance regarding plant protection measures	95	90.48
2	Lack of knowledge regarding quantity and concentrations of chemicals to be used	89	84.76
3	Lack of knowledge regarding identification of pests, their nature of damage, diseases and their symptoms	82	78.10
II	**Constraints regarding plant protection chemicals and equipments**		
1	Unavailability of required insecticides and fungicides at village level	87	82.86
2	High cost of plant protection chemicals and equipments	73	69.52
4	Unavailability of plant protection equipments on hire basis	69	65.71
6	Lack of facilities for repairing plant protection equipments at village level	65	61.90
III	**Other constraints**		
1	Lack of finance	45	49.52
2	Sudden rainfall after spraying causes washing off plant protection chemicals	13	12.38

In case of constraints regarding plant protection chemicals and equipments, ‘unavailability of required insecticides and fungicides at village level’ was the most frequent constraint faced by 82.86 per cent of the respondents followed by ‘high cost of plant protection chemicals and equipments’ (69.52 per cent), ‘unavailability of plant protection equipments on hire basis’ (65.71 per cent) and ‘lack of facilities for repairing plant protection equipments at village level’ (61.90 per cent).

Other important constraints faced by the mango growers were ‘lack of finance’ (49.52 per cent) and ‘sudden rainfall after spraying causes washing off plant protection chemicals’ (12.38 per cent).

4.5 Suggestions made by the mango growers to overcome the constraints in adoption of plant protection measures

Considering the constraints faced by the mango growers in adoption of plant protection measures, they were asked for the solutions in order to overcome the constraints for control of different pest and diseases in mango. The suggestions given by the mango growers are presented in Table 22.

It can be depicted from Table 22 that the major suggestions made by the mango growers to overcome constraints regarding knowledge of plant protection measures were ‘information regarding recommended doses of insecticides and fungicides should be given by expert personnel at village level’ (85.71 per cent), ‘training should be organized more often at village level for mango growers regarding identification of pests, their nature of damage, diseases and their symptoms’ (80.95 per cent),

ôinformation about recommended plant protection measures should be displayed at public placesô (34.28 per cent) and ôneed to establish good linkages between farmers and research system for proper guidanceô (22.86 per cent).

Table 22: Suggestions made by the mango growers to overcome the constraints in adoption of plant protection measures

Sr. No.	Suggestions	Respondents n= 105	
		Number	Percent
I	**Suggestions regarding knowledge of plant protection measures**		
1	Information regarding recommended doses of insecticides and fungicides should be given by expert personnel at village level	90	85.71
2	Training should be organized more often at village level for mango growers regarding identification of pests, their nature of damage, diseases and their symptoms	85	80.95
3	Information about recommended plant protection measures should be displayed at public places	36	34.28
4	Need to establish good linkages between farmers and research system for proper guidance	24	22.86
II	**Suggestions regarding plant protection chemicals and equipments**		
1	Insecticides and fungicides should be made available on time at village level	87	82.86
2	Cost of plant protection chemicals and equipments should be reduced	73	69.52

3	Plant protection equipments of high cost should be made available on hire basis at village level	65	61.90
4	Facilities for repairing plant protection equipments should be provided at village level	65	61.90
III	**Other suggestions**		
1	Financial support should be provided by the government	45	42.85
2	Outbreak weather situations should be forecasted regularly through newspaper or TV channel	13	12.38
3	Establishment of Agri- clinic at village level	5	04.76

To overcome the constraints regarding plant protection chemicals and equipments, 82.86 per cent of the mango growers suggested that ôinsecticides and fungicides should be made available on time at village levelô, whereas other suggestions given by them were ôcost of plant protection chemicals and equipments should be reducedô (69.52 per cent), ôplant protection equipments of high cost should be made available on hire basis at village levelô (61.90 per cent) and ôfacilities for repairing plant protection equipments should be provided at village levelô (61.90 per cent).

The important suggestions made by the mango growers were ôfinancial support should be provided by the governmentô (42.85 per cent), ôoutbreak weather situations should be forecasted regularly through newspaper or TV channelô (12.38 per cent) and ôestablishment of Agri-clinic at village levelô (04.76 per cent).

5. SUMMARY, CONCLUSIONS AND IMPLICATONS

5.1 Summary and Conclusions

India with diverse climatic conditions and soil types provides tremendous opportunity to grow a wide range of horticultural crops. India is the largest fruit producing country. In year 2012-13 the total fruit production in India has been estimated 81.29 million tonnes on an area of 6.98 million hectares. Mango is the major fruit crop grown in the country. Total mango production in India is 18.00 million tonnes with 22.1 per cent share in total fruit production. In India mango is grown on 2.5 million ha which contributes 35.8 per cent share in total area under fruit crops. Irrespective to the reality that India is having a comparative advantage over other mango producing countries in terms of total production still the productivity (7.2 tonnes/ha) continues to be low.

Maharashtra is one of the major states in case of area under mango (0.48 million ha) but total mango production of the state is low as compared to other states (0.63 million tonnes). Hence, productivity of mango in Maharashtra is tends to be very low (1.3 tonnes/ha).

As mango is susceptible to incidence of different pests and diseases, their occurrence is the important factor influencing its production and productivity.

The first factor is the pest infestation, which affects the production and productivity of mango adversely. The crop has been reported to be infested by 551 pests in the different parts of the world, which include 492 species of insects, 17 species of mites, 26 species of nematodes, 9 species of birds and 7 species of animals. Mango hopper, mealy bug, gall midge, stem borer, fruit flies, shoot borer and thrips are considered as the major pests in our country. In India, the greatest damage to the mango

crop is caused by mango hoppers and they are responsible for the total crop failure.

The other factor influencing production of the mango is infection of different diseases. All plant parts of mango like trunk, branches, leaves, petioles, flowers and fruits are attacked by various pathogens. These may be either fungi or bacteria. These pathogens cause several kinds of rots, die- back, anthracnose, scab, necrosis, blotch, spots, mildew etc. Some of these diseases are causing heavy losses in mango production in some regions. Powdery mildew has been known to cause a complete failure of the crop and is one of the worst diseases of mango affecting almost all the varieties. This disease alone causes approximately 20.00 per cent crop loss in Maharashtra state. Loranthus which grows as an ecto- parasite on mango tree also affects the crop adversely.

The loss of yield in mango is due to occurrence of different pest and diseases and inability to control the same by growers due to lack of knowledge. Generally, it is observed that mango growers do not adopt plant protection measures on large scale, which is one of the main constraints in increasing the average yield per hectare. Taking into consideration all these facts, it is necessary that mango growers should have knowledge about the appropriate plant protection measures and they should adopt those plant protection measures to keep their mango crop free from pest and disease infestations so that they can increase production and productivity of mango.

The present study was under taken in Kolhapur district of western Maharashtra region which is adjacent to the leading region in mango production i.e. South Konkan. Two tehsils from Kolhapur district with highest area under mango crop were selected for the research study *viz;*

Chandgad and Gadhinglaj. Information regarding the progressive mango growers was obtained from the Taluka Agriculture Officer and then 105 respondents from two tehsils were selected purposively considering the conveyance, roadside access to the orchard and objectives of the study.

The data from mango growers were collected through personal interview schedule. The qualitative data were converted into quantitative form. The independent and dependent variables were measured by assigning score. The frequencies and percentage were worked out to describe the characteristics of mango growers.

The findings are summarized as below.

5.1.1 Personal and socio-economic characteristics of the mango growers

The study revealed that,

1. Three- fifth (60.00 per cent) of the mango growers were belonged to ómiddleô age group.
2. Majority (37.14 per cent) of the mango growers had education up to ósecondary levelô.
3. Two- fifth (40.00 per cent) of the mango growers had ósemi-mediumô (2.01 to 4.00 ha) size of land holding.
4. Majority (70.48 per cent) of the mango growers had ósmallô area (Up to 1.00 ha) under mango cultivation.
5. More than two- fifth (41.90 per cent) of the mango growers had annual income between ` 1,00,001 to ` 2,00,000.
6. Most of the (82.86 per cent) mango growers were getting ómediumô income (` 11,943- ` 87,199) through mango production.

7. More than three- fifth (62.86 per cent) of the mango growers had ómediumô information sources.
8. Less than one- half (44.76 per cent) of the mango growers had ólowô level of extension contact.
9. More than one- third (37.14 per cent) of the mango growers were using knapsack sprayer.

5.1.2 Extent of knowledge of the mango growers regarding plant protection measures

The study revealed that majority (65.71 per cent) of the mango growers had ómediumô level of knowledge regarding plant protection measures.

5.1.3 Adoption level of plant protection measures followed by the mango growers

The study depicted that majority (66.67 per cent) of the mango growers had ómediumô level of adoption regarding plant protection measures.

5.1.4 Constraints faced by the mango growers in adoption of recommended plant protection measures

The major constraint faced by the mango growers were;

1. Lack of technical and scientific guidance regarding plant protection measures followed by lack of knowledge regarding quantity and concentrations of chemicals to be used and lack of knowledge regarding identification of pests, their nature of damage, diseases and their symptoms.
2. Unavailability of required insecticides and fungicides at village level was the most frequent constraint followed by high cost of plant

protection chemicals and equipments, unavailability of plant protection equipments on hire basis and lack of facilities for repairing plant protection equipments at village level.

3. Lack of finance and sudden rainfall after spraying causes washing off plant protection.

5.1.5 Suggestions made by the mango growers to overcome the constraints in adoption of plant protection measures

The major suggestions made by the mango growers to overcome constraints regarding adoption of plant protection measures were;

1. Information regarding recommended doses of insecticides and fungicides should be given by expert personnel at village level, training should be organized more often at village level for mango growers regarding identification of pests, their nature of damage, diseases and their symptoms, information about recommended plant protection measures should be displayed at public places. Need to establish good linkages between farmers and research system for proper guidance.
2. Insecticides and fungicides should be made available on time at village level, cost of plant protection chemicals and equipments should be reduced, plant protection equipments of high cost should be made available on hire basis at village level, facilities for repairing plant protection equipments should be provided at village level.
3. The other suggestions given by the respondents were financial support should be provided by the government, outbreak weather situations should be forecasted regularly through newspaper or TV channel and establishment of Agri- clinic at village level.

5.2 Implications

The implications documented based on the outcomes of the study should be of great utility in developing horticulture in Kolhapur district. The research study would be highly useful in understanding the characteristics of the farmers and their knowledge level and extent of adoption regarding recommended plant protection measures. Moreover the results of this study would serve as pace setter for future endeavours of farmers, researchers and extension workers.

On the basis of the findings of this study the following implications are drawn.

1. Agricultural Universities and State Department of Agriculture should provide proper scientific and technical guidance regarding recommended plant protection measures of mango through trainings under different human resource development programmes at block as well as at village level.
2. Integrated pest and disease management measures should be undertaken by the mango growers and accordingly extension agency should give more emphasis on this aspect.
3. Demonstrations regarding plant protection measures should be undertaken by extension agencies.
4. Area under mango cultivation and income generated through mango found less. Hence, efforts should be made for area expansion under mango and inducing marketing attitude toward mango cultivation among the farmers by Agricultural Universities and State Department of Agriculture.

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*Original not seen

Fig. 1: Distribution of the mango growers according to their age group

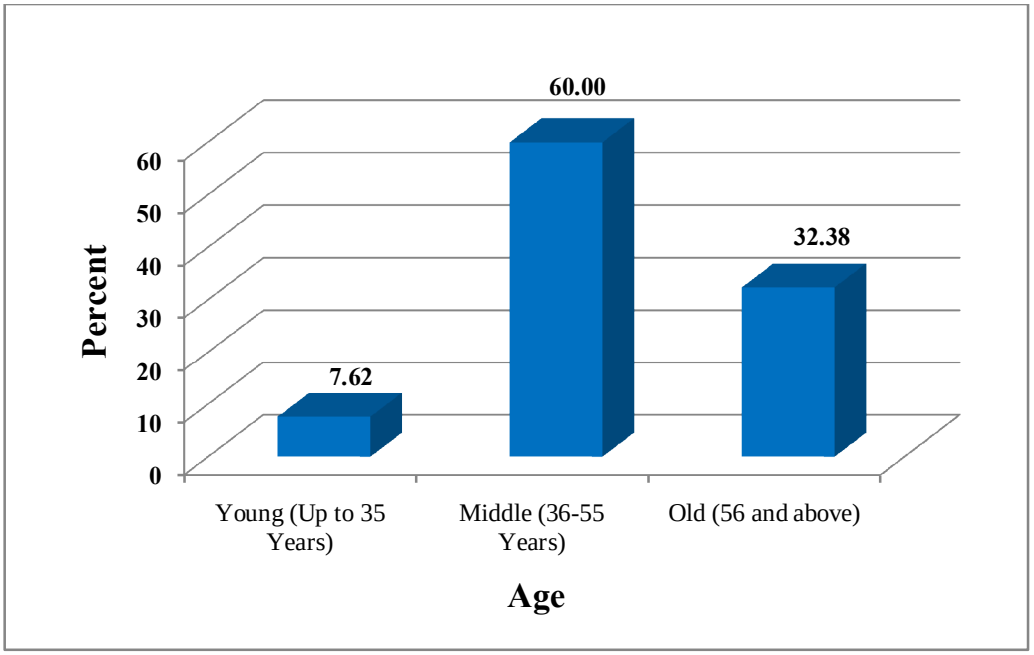

Fig. 2: Distribution of the mango growers according to their education level

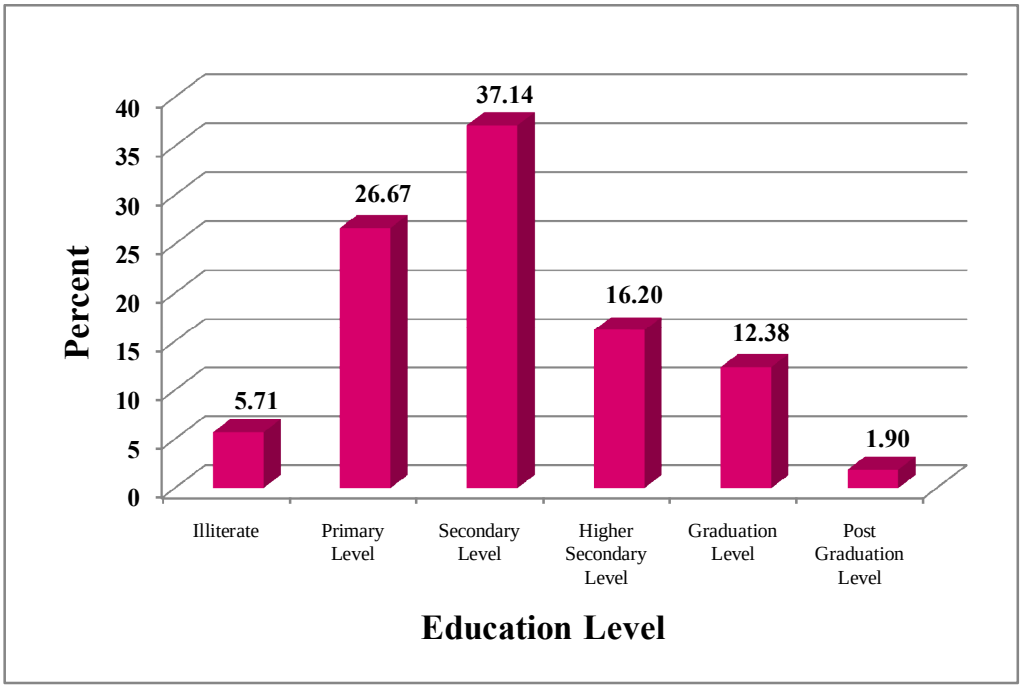

Fig. 3: Distribution of the mango growers according to their size of land holding

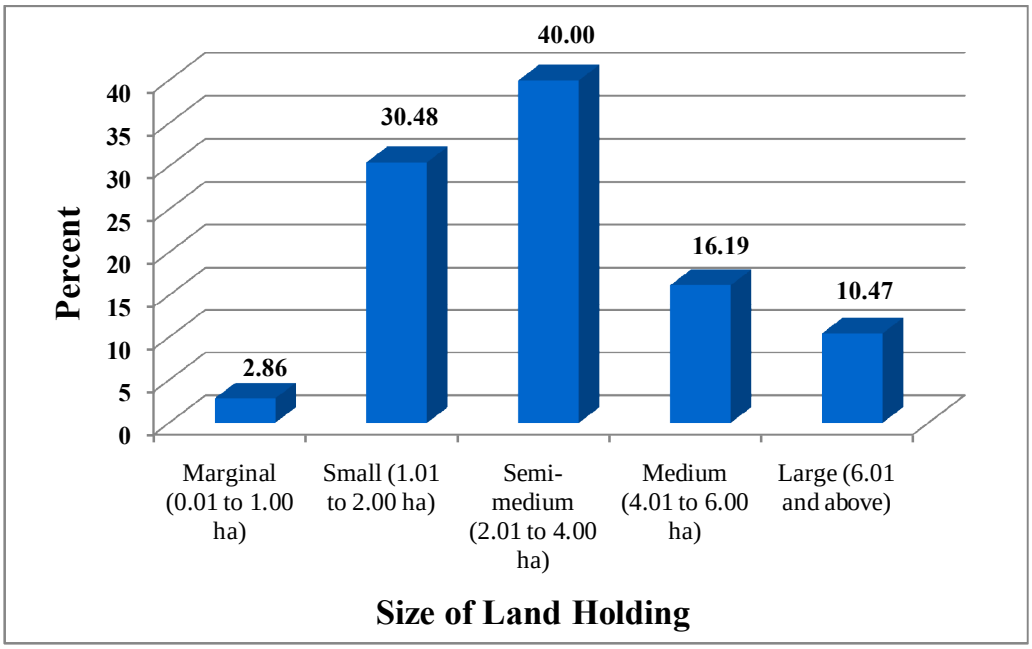

Fig. 4: Distribution of the mango growers according to their area under mango cultivation

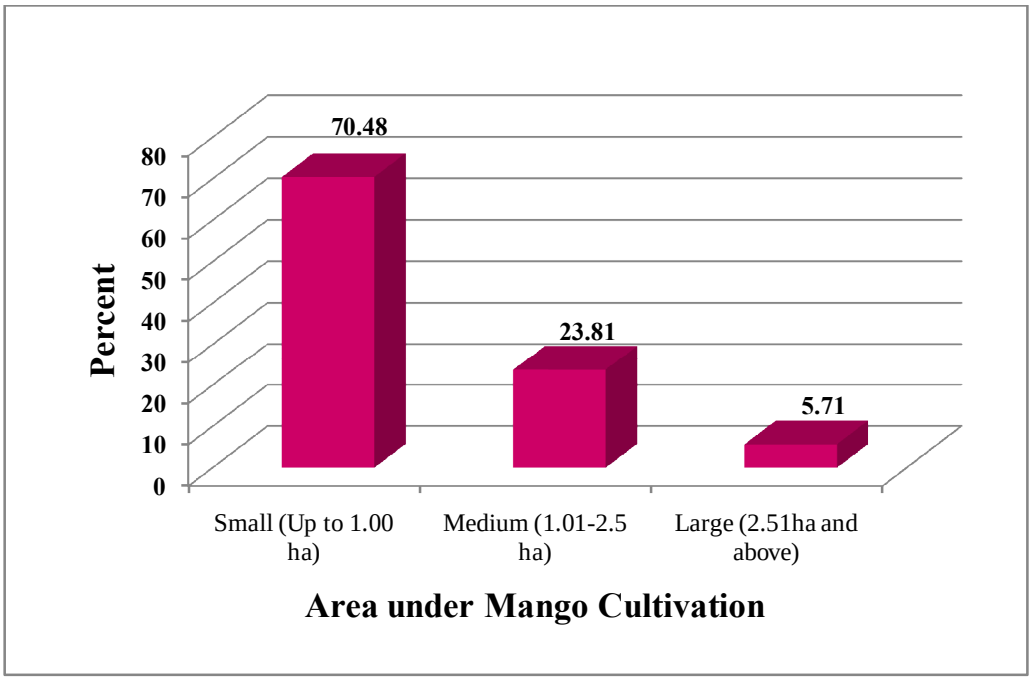

Fig. 5: Distribution of the mango growers according to their annual income

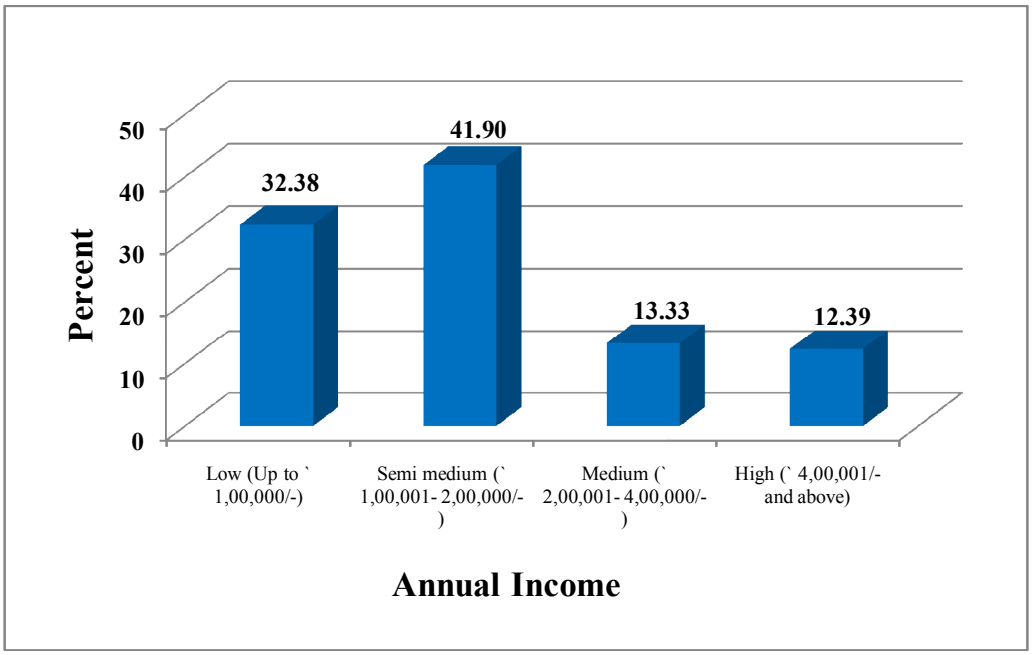

Fig. 6: Distribution of the mango growers according to their income through mango production

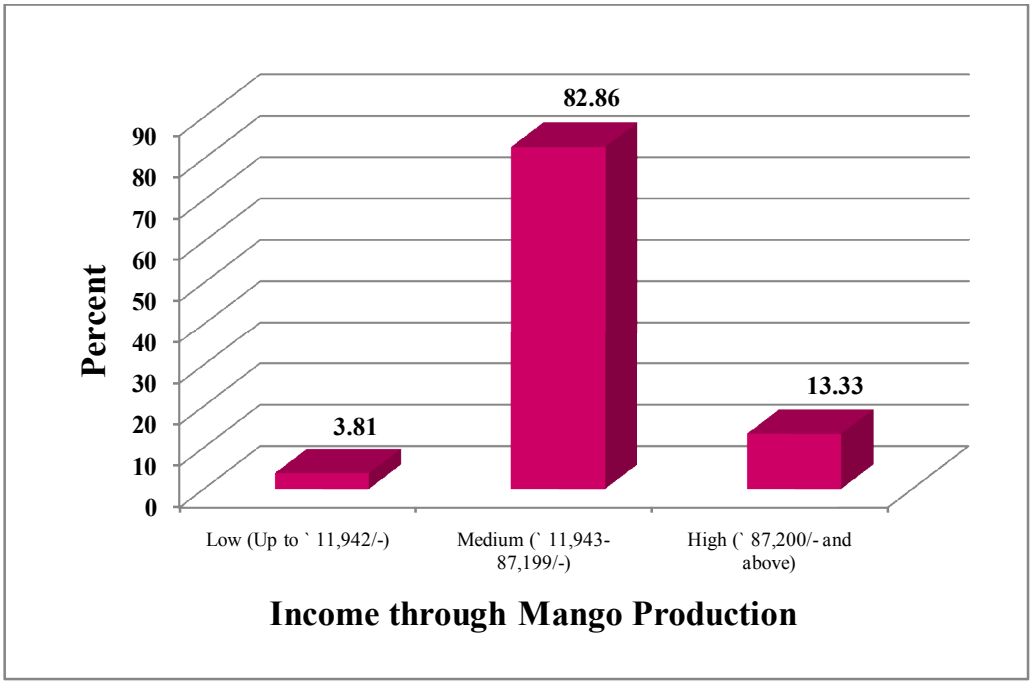

Fig. 7: Distribution of the mango growers according to their sources of information

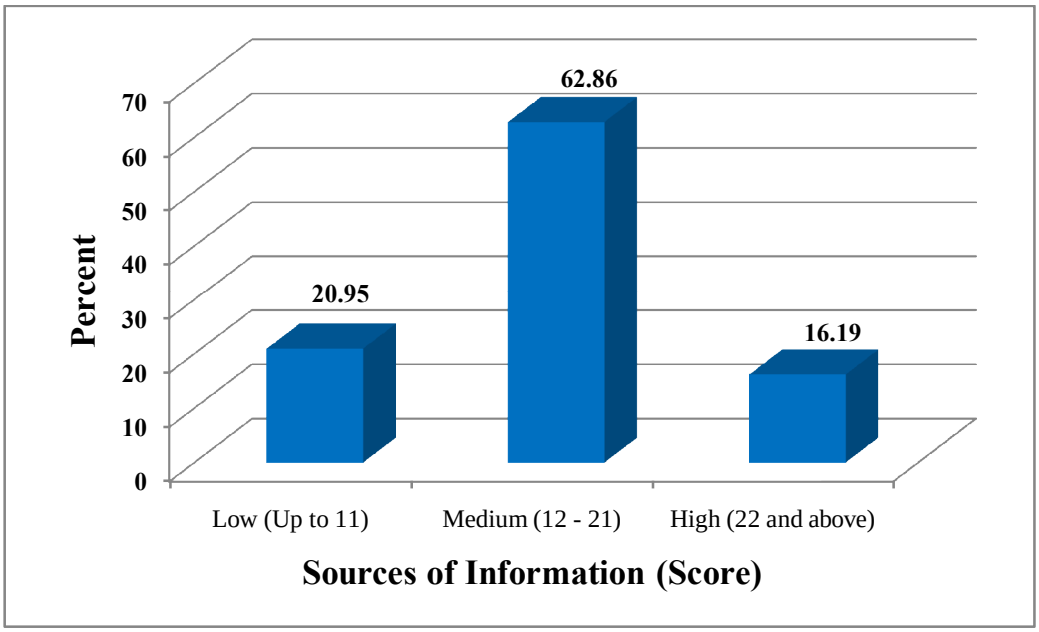

Fig. 8: Distribution of the mango growers according to their extension contact

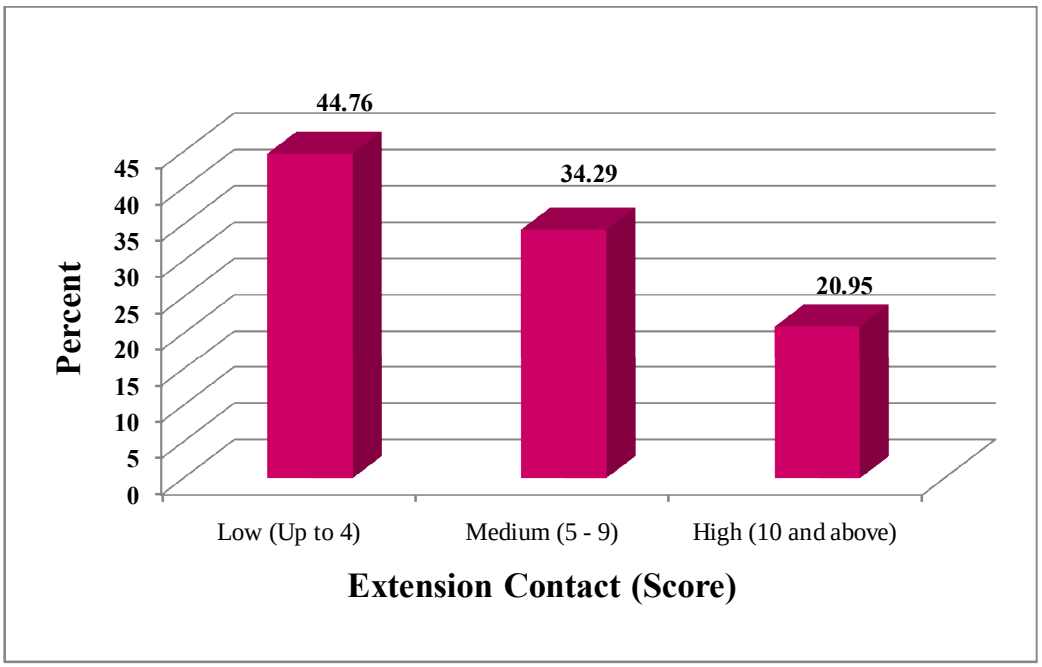

Fig. 9: Distribution of the mango growers according to use of plant protection equipments

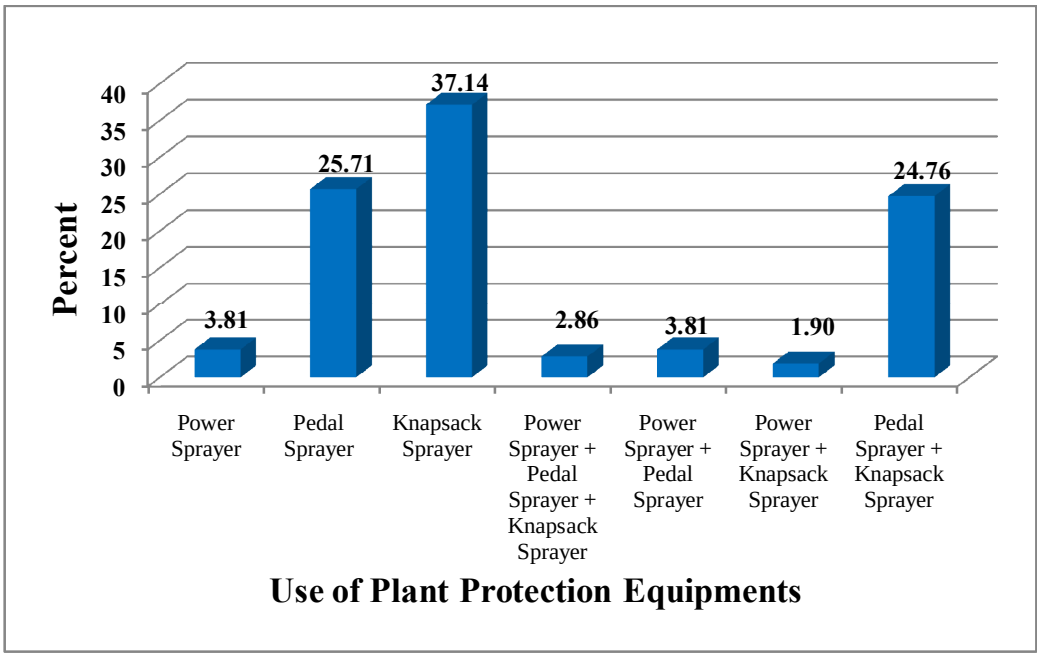

Fig. 10: Distribution of the mango growers according to their level of knowledge

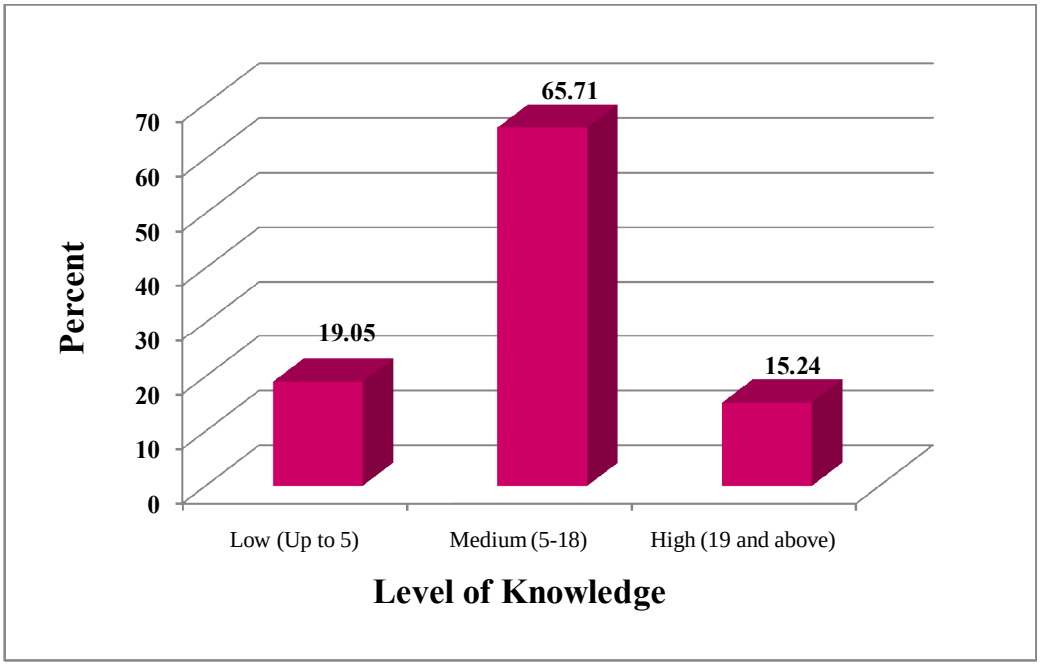

Fig. 11: Distribution of the mango growers according to their level of adoption

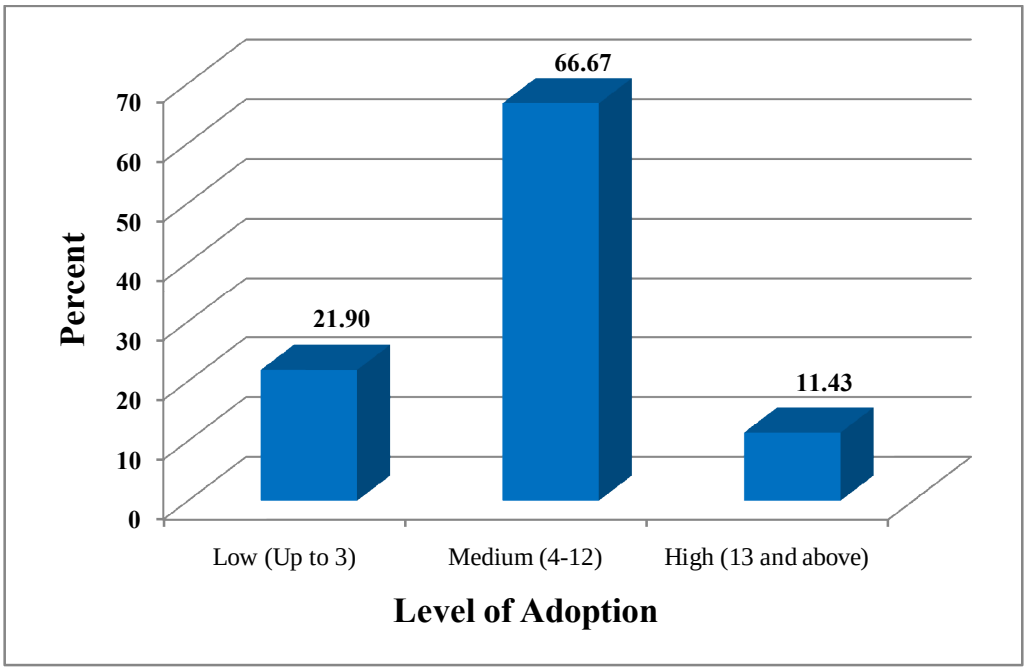

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

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of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL EXTENSION

2014

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