A STUDY ON KNOWLEDGE AND ADOPTION OF POST-HARVEST MANAGEMENT PRACTICES AMONG THE MANGO GROWERS OF NORTHERN KARNATAKA

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1. INTRODUCTION

India having varied agro-climatic conditions, occupies a prominent place in the horticulture map of the world. In the country, horticulture crops, which occupied an area of 20.10 million hectares with a production of 207.00 million tonnes during 2007-08 and have generated ten per cent of the total income and over 30 to 40 per cent of the income derived from combined agriculture sector. And in fruit production, India has emerged as the world leader with a production of 63.50 million tonnes from an area of 5.77 million ha (Anonymous, 2008). But, there is considerable gap between the gross production and net availability of fruits due to post-harvest loss of about 30 per cent. Furthermore, only less than 2 per cent of the produce is used for processing compared to 70 per cent in Brazil, 65 per cent in USA, 83 per cent in Malaysia and 50 per cent in Israel. Therefore, in order to achieve our target of feeding the population as well as meeting the requirement of processing industry and export trade, only increasing production and productivity of horticultural crops will not be enough, a lot more emphasis needs to be given to post-harvest management of fruits.

Among the major fruits of India, mango (*Mangifera indica* L.) is eulogized as the king of fruits. It belongs to the dicotyledonous family Anacardiaceae. It is believed that the fruit originated from India and its cultivation has been traced back to more than 6000 years in the past. Groves and gardens of mango find mention in descriptions in the epics of Ramayana and Mahabharat also. Mango is grown in all tropical countries (Anonymous, 2008). Mango fruits are greatly relished for their succulence, pleasant flavour and delicious taste. They are also a rich source of Beta-carotene, the precursor of vitamin A, which is essential for the prevention of night blindness in human beings and rich source of vitamin C also.

Mango is an evergreen perennial fruit tree that is propagated vegetatively under active cultivation. The plant starts bearing fruits generally from the fourth year of planting. Mango flourishes at altitudes ranging from the sea level to an altitude of 1400 m above the mean sea level. The optimum temperature range for better growth and fruit production is 24^0 to 27^0C though, it can withstand temperature upto 48^0C. It grows in areas having an annual rainfall ranging from as low as 25 cm to as high as 200 cm. Its hardiness has been exploited in the dry tracts where it is becoming a popular dryland horticultural crop. Mango thrives well on wide variety of soils, to the exception of water logged conditions, alkaline and rocky soils, which are to be avoided for mango cultivation. Thus, the character of adaptability of mango tree provides an opportunity for large scale commercial planting of mango in areas receiving less rainfall in the entire country with favourable temperature and soil conditions to complement its unarrested growth.

India produces 13.70 million tonnes of mango from an area of 2.20 million hectare has the share of 38.00 per cent area and 21.70 per cent production of major fruits (Anonymous, 2008).

There are more than 3000 named varieties of mango. Among these, Dashehari, Langra and Chausa are the popular varieties of the northern regions of the country, while Alphanso and Pairi are popular in Deccan Plateau and Western regions. Totapuri, Neelam and Benishan are the important varieties of South India. During 2007-08, Andhra Pradesh was the leading state in mango cultivation with an area of 0.48 million hectares followed by Maharashtra (0.45 million hectares) and Uttar Pradesh (0.26 million hectares). Whereas, Karnataka state ranks 7^{th} in area (0.13 million hectares) and 3^{rd} in production (1.33 mt).

In Karnataka, Kolar and Bangalore rural are the largest mango growing districts with an area of 33770 and 20300 hectares produces 62200 and 69520 tonnes, respectively. Whereas, Dharwad and Belgaum are the major mango growing districts in Northern Karnataka with an area of 4569 and 3964 ha producing of 55612 and 50673 tonnes, respectively (Anonymous, 2008-09). The success of mango industry in different mango growing regions of Karnataka is attributed to the geographical situation with amazing diversity in micro as well as macro climate.

But, the post harvest loss of about 17.1 to 36.7 per cent has resulted in net availability of about 8826 tonnes of mango (NHB, 2007-08). The unscientific post-harvest handling will result in increased post-harvest loss rate. Therefore, loss rate has to be gradually cut down in order to achieve the target of surplus produce for industry and export after meeting the nutritional requirement of the country.

Post harvest management practices are inter disciplinary “Science and Technology” applied to mango after harvest for its protection, conservation, processing, packaging, distribution, marketing and utilization to meet the nutritional requirements of the people in relation to their needs. Importance of post harvest management practices in mango lies in the fact that it has the capability to meet requirement of growing population by elimination losses, making more nutritive items from its pulp by proper processing and fortification.

Eventhough, number of post harvest management practices are being recommended to maximise benefits, the mango growers are not adopting the recommended practices. Thus, the technologies vary from farmer to farmer according to their personal and socio-economic characteristics, perceived training needs, availability of factors of production and the problems in post harvest management.

Therefore, an appropriate understanding of the level of knowledge and extent of adoption of recommended post harvest management practices and the constraints analysis would help to arrive at appropriate extension and research strategies to increase the rate of adoption. Keeping this in view, the present investigation was conducted in the predominantly mango growing Dharwad and Belgaum districts of Northern Karnataka with the following specific objectives.

Objectives

1. To study the entrepreneurial characteristics of established mango growers
2. To measure the extent of knowledge possessed by the mango growers about post-harvest management practices
3. To measure the extent of adoption of improved post-harvest management practices in mango
4. To determine the relationship of entrepreneurial characteristics with knowledge and adoption of post-harvest management practices, and
5. To analyse the constraints faced by mango growers in adoption of improved post-harvest management practices

Scope of the study

This study is of prime importance, which tries to focus on knowledge of mango growers about Post-Harvest Management (PHM) practices and the extent of adoption of the same. It will highlight the nature of influence of entrepreneurial characteristics and problems faced by the mango growers in adoption of post-harvest management practices. Hence, the identified gaps in adoption of recommended management practices will give direction to field extension workers to manipulate appropriate factors to increase the adoption.

Thus, the out come of the study will be of much use to researchers, development departments and extension workers to design appropriate research and extension programmes to meet the needs of mango growers and promote mango industry.

Limitations of the study

The study was confined to two major mango growing districts of Karnataka State due to limitations of time and other resources at the disposal of researcher. However, considerable care and thought was exercised in making the study as scientific, systematic and objective as possible.

It is a qualitative study based on personal bias and prejudice of the mango growers. Hence, the findings have to be viewed in the specific context of the conditions prevailing in the study area.

2. REVIEW OF LITERATURE

Reviews of existing literature relevant to the study area were limited. Hence, an attempt was made to gather the related literature on horticultural crops growing farmers under the following headings.

2.1 Entrepreneurial characteristics of horticulture crops growers

2.2 Extent of knowledge possessed by the horticulture crop growers about post-harvest management practices

2.3 Extent of adoption of improved post-harvest management practices in horticultural crops

2.4 Relationship of entrepreneurial characteristics with knowledge and adoption of post-harvest management practices in horticultural crops

2.5 Constraints faced by horticultural crops growers in adoption of improved post-harvest management practices

2.1 Entrepreneurial characteristics of horticulture crops growers

2.1.1 Education

Jayale (1992) observed that 15.83 per cent of the horticulture crop growers were illiterate, 18.33 per cent could only read and another 18.33 per cent of them could read and write, 8.43 per cent of respondents were noticed to had education upto primary and middle school level. However, one-fourth of the respondents (22.50%) studied upto high school level and only 8.33 per cent of respondents were graduates.

Srinivasa Reddy (1995) in his study on mango growers of Kolar district in Karnataka observed that 28.00 per cent of the respondents were educated upto high school, 25.00 per cent were illiterate, 19.00 per cent of the respondents studied upto primary school. And only 7.00 per cent of the mango growers had education upto graduation level

Saravana Kumar (1996) revealed that 27.50 per cent of the mango growers of Dharmapuri district in Tamil Nadu had studied upto college level, 23.33 per cent and 9.16 per cent of the respondents were educated upto primary school and graduation, respectively. Whereas, only 1.67 per cent of the respondents were found to be illiterate

Angadi (1999) reported that 30 per cent of the pomegranate growers had studied up to middle school followed by 20.62 per cent who had studied up to high school, while 22.50 per cent of the respondents were illiterate farmers. Whereas only 3.75 per cent of them had received primary education and graduation was done by nearly 12 per cent.

Shashidhara (2003) in his study on drip irrigating followed farmers in Shimoga and Davanagere districts noticed that 31.11 per cent were studied upto high school, 30.00 per cent had the graduation and 24.44 per cent educated upto pre-university whereas middle and primary school education was possessed by 8.89 and 5.56 per cent, respectively.

Moulasab (2004) in his study on mango growers in North Karnataka indicated that, more than 23.00 per cent of growers were educated up to primary school, followed by higher secondary school (19.16%) and 14.16 per cent of them were noticed to be illiterates.

2.1.2 Land holding

Patalia (1991) conducted a study on mango cultivators of Parbhani district in Maharashtra and reported that 50.00 per cent of the respondents had small land holding upto 2 hectares and 47.50 per cent of the respondents had medium land holding ranging from 2.10 to 6.00 hectares. Only 2.50 per cent respondents had land holding above 6.10 hectares.

Saravana Kumar (1996) in his study in Krishnagiri, Dharmapuri district of Tamil Nadu observed that majority of the mango growers (64.18%) had medium land holding, while 21.66 and 14.66 had small and big land holdings, respectively.

Vijaya Kumar (1997) in his study on rose growers in Bangalore district revealed that, 75 per cent of the rose growers belonged to small farmers category, followed by medium (23.00%) and big (2.00%) farmers category.

Angadi (1999) in his study in Bagalkot district of Karnataka found that majority of the pomegranate growers (62.50%) had big farm size and only 6.25 per cent had lesser land holdings.

Shashidhar (2003) in a study on socio-economic profile of drip irrigation farmers in Shimoga and Davanagere districts of Karnataka state revealed that comparatively more number of farmers (46.67%) belonged to semi-medium category followed by medium (32.22%) and small land holding category (18.89%).

Patel (2005) conducted a study on peasantry modernization in Integrated Tribal Development Project area of Dahod district of Gujarat and state revealed that, slightly more than half of the respondents (52%) found to have small size land holding (1.1 to 2.0 ha.), followed by (40%) marginal size land holding (up to 1.0 ha.). Only 8.00 per cent of the respondents fell in the category of medium size of land holding (2.0 ha).

2.1.3 Farming experience

Patalia (1991) conducted a study in Parbhani district of Maharashtra state and observed that majority of the mango cultivation farmers (54.17%) were cultivating mango since from last ten years whereas 28.67 per cent of farmers had ten to twenty years of farming experience.

Chandregowda (1997) observed that majority of chrysanthemum growers in eastern dry zone of Karnataka had low farming experience (48.33%), followed by medium (34.67%) and high (17.00%) farming experience, respectively.

Vijayakumar and Narayanagowda (1999) in their study in Bangalore district reported that majority of the rose growers had low level of farming experiences (61.00%).

Birajdar (2002) found that 18.00 and 11.66 per cent of the respondents had experiences of 21 to 25 years and 16 to 20 years, respectively and only 3.00 per cent of the respondents had grape farming experiences of less than 10 years.

2.1.4 Mass media utilization

Sarvanakumar (1996) observed that 23.33 per cent of mango growers of Dharmapuri district subscribed for news paper and farm magazines and read them regularly, while 37.51 and 39.85 per cent of the respondents regularly listened and viewed the agricultural programmes respectively.

Dhamodharan and Vasanthkumar (2001) noticed that more than 50.00 per cent of sugarcane growers had medium level of mass media exposure, followed by 40.00 per cent of the respondents with high level of mass media exposure.

Vedamurthy (2002) in his study on arecanut growers of Shimoga district in Karnataka observed that 46.00 per cent were medium mass media users, while 32.00 per cent had high mass media use and 22.00 per cent were of low mass media users.

Shashidhara (2003) his study reported that 41.11 per cent of the respondents belonged to medium level of mass media participation, followed by low level (35.56%) of mass media participation, whereas 23.33 per cent of respondents were noticed in high mass media participation.

Sunil Kumar (2004) revealed that, 59.17 per cent of the tomato growers of North Karnataka were occasionally listening agricultural programmes in radio, whereas 30.00 per cent of them viewed agricultural programmes in television occasionally. But, a high per cent of (70.83% and 85.00%) respondents never used to read the newspaper (70.83%) and farm magazines (85.00%).

2.1.5 Risk Orientation

Ajay Kumar (1989) found that an equal per cent of grape growers of Rangareddy district in Andhra Pradesh had high (32%), low (33%) and medium level of risk orientation (35%).

Ananda (1992) in the study conducted on grape growers of Bangalore district in Karnataka indicated that 48.64 per cent of drip irrigating respondents had medium risk orientation followed by 38.36 per cent of high and 13.00 per cent of them had low risk orientation.

Ravishankar (1995) in his study observed that 65 per cent of the potato respondents had medium level of risk bearing capacity followed by high (20.00%) and low (15.00%) level of risk orientation, respectively.

Sakharkar (1995) observed that 64.00 per cent of farmers showed medium risk taking ability whereas, 16.00 and 20.00 per cent of farmers had low and high risk taking ability, respectively.

Saravanakumar (1996) in his study in Krishnagiri taluk of Dharmapuri district in Tamil Nadu observed that, majority of the mango growers (65.83%) belonged to medium level of risk orientation followed by low (15.00%) and high (19.17%) level of risk orientation, respectively.

Birajdar (1999) reported that majority of the grape growers belonged to medium risk orientation category followed by high category (86.30%) and low category (13.70%).

Sawant (1999) observed that, majority (75.00%) of mushroom cultivation in Maharashtra had medium risk bearing capacity while 17.00 per cent had high risk bearing capacity.

Babanna (2001) conducted a study on arecanut growers of Shimoga district in Karnataka and pointed out that 37.50 per cent of arecanut growers belonged to medium category followed by 31.70 per cent of them had high risk orientation. The remaining 30.80 per cent of them were having low risk orientation.

Chandrapaul (1998) conducted study on entrepreneurial behaviour of vegetable growers in Hyderabad and revealed that 52.50 per cent of respondents had medium achievement motivation followed by more or less equal percentage of respondents in low (22.50%) and high (25.00%) achievement motivation categories, respectively.

Vijay Kumar (2001) reported that 44.16 per cent of floriculture farmers in Hyderabad had medium achievement motivation followed by 28.34 and 27.50 per cent of respondents noticed in low and high achievement motivation, respectively.

Vedamurthy (2002) in his study on arecanut growers of Shimoga district in Karnataka reported that 45.34 per cent of areca growers belonged to medium category followed by 38.00 per cent noticed high risk orientation, and 16.66 per cent possessed low risk orientation.

Venkataramalu (2003) reported that majority of the farmers had medium level of risk bearing capacity (73.33%).

Shashidhar (2004) revealed that majority of horticulture farmers of Bijapur district (70.83%) had medium level of risk bearing ability and very less percentage (15.00%) had level of risk orientation.

2.1.6 Extension participation

Gotyal (1989) reported that majority of lime growers never participated in field visits (76.00%), discussion meetings (74.00%), conducted tours (66.00%) and training programmes (64.67%). However, 63.33 per cent of the respondents participated occasionally in the demonstrations.

Yogananda (1992) observed that majority of coconut growers (78.33%) did not participate in educational tour. Similarly, 61.00 per cent of the small coconut growers did not participate in meetings, educational tours and training programmes.

Vijaya Kumar (1997) observed that, moderate percentage of the rose growers participated in extension activities like Krishimela (42.33%) and field days (31.00%). Most of the farmers never participated in group discussion meetings and training programmes.

Angadi (1999) witnessed that majority of pomegranate growing respondents did not participate in various activities like discussion with extension personnel (98.76%), group meetings (75.23%) and training programmes (72.50%), whereas regular participation in method demonstration and Krishimela were noticed with 43.75 and 38.13 per cent of the respondents respectively.

Gupta (1999) reported that about 74.00 per cent respondents were aware of training programmes of which only 36.00 per cent of respondents had participated in the training programmes, whereas 56.00 per cent respondents were aware of demonstrations and only 4.66 per cent of farmers had participated. But, none of the respondents had participated in field days and field visits.

Kanavi (2000) conducted a study on the knowledge and adoption behaviour of growers in Belgaum district of Karnataka reported that, none of the respondents participated regularly in training and demonstrations. Nearly one third (31.33%) of respondents participated regularly in Krishimela. Whereas, very less number of respondents participated in extension activities like farm visits (1.33%), group discussion (2.66%) and study tour (4.00%). Whereas, 20 per cent participated occasionally in Krishimela followed by very less percentage participated in trainings (4.66%), group discussion (4.00%), demonstration and farm visits (2.00%) and study tour (0. 66%).

Venkataramalu (2003) in a study on the knowledge and adoption behaviour of chilli growers in Guntur district of Andhra Pradesh highlighted that, majority of the farmers participated in discussion with village extension workers (70.00%), Krishimela (62.50%) and exhibitions on agriculture (61.67%).

Shashidhara (2004) conducted a study on drip irrigation farmers of Bijapur district and revealed that 45.83 per cent of horticultural crop growers participated in group meetings, followed by exhibition (41.66%) and only 18.33 per cent of the respondents participated in Krishimela.

Sunil Kumar (2004) in a study on tomato crop growers of Belgaum district in Karnataka revealed that nearly 23.83 per cent of respondents participated regularly in demonstrations, followed by agricultural exhibition (23.00%). But, majority of them never attended in the activities like training (66.67%), educational tours (94.17%) and field visits (92.05%).

2.1.7 Achievement motivation

Sivanarayana (1990) reported that majority (77.50%) of the respondents had medium level of achievement motivation followed by less percentage in low (13.33%) and high (9.17%) level of achievement motivation.

Raghavendra (1997) conducted a study on arecanut growers of South Canara district in Karnataka. He revealed that more number of the arecanut growers (41.00%) belonged to medium achievement motivation category followed by high (35.00%) and low (24.0%) achievement motivation category.

Chandrapaul (1998) conducted a study on entrepreneurial behaviour of vegetable growers in Hyderabad and revealed that 52.50 per cent of respondents had medium achievement motivation followed by more or less equal percentage of respondents in low (22.50%) and high (25.00%) achievement motivation categories.

Palaniswamy and Sriram (2001) observed that 72.11 per cent of sugarcane growers belonged to medium level of achievement motivation category, while 14.28 and 13.61 per cent of respondents belonged to high and low level of achievement motivation category, respectively.

Vijay Kumar (2001) conducted study on entrepreneurial behaviour of floriculture farmers in Hyderabad and reported that 44.16 per cent of respondents had medium achievement motivation followed by 28.34 and 27.50 per cent of respondents in low and high achievement motivation, respectively

Govindagowda (2002) reported that nearly fifty per cent of Thompson seedless growers (47.00%) had high achievement motivation, while 48 per cent of Bangalore blue growers had medium achievement motivation. Further, a majority of big farmers (64.00%) were belonged to high achievement motivation level, while 38 per cent of small farmers were noticed to possessed medium achievement motivation. In case of Bangalore blue, 44 per cent of big and 52 per cent of small farmers were belonged to medium achievement motivation.

Nagesh (2005) in his study on Entrepreneurial behaviour of Vegetable seed producing farmers of Haveri district revealed that 71.66 per cent of vegetable seed production farmers had medium achievement motivation, followed by more or less equal percentage of respondents in low (15.00%) and high (13.34%) achievement motivation, respectively.

2.1.8 Economic motivation

Ramesh Babu (1987) in a study on grape growers of Bangalore and Kolar districts in Karnataka observed that 38.33 per cent of respondents had high economic motivation, whereas more number of respondents (61.67%) had low level of economic motivation.

Srinivas Reddy (1995) reported that 40.00 per cent mango growers of Kolar district in Karnataka state had high level of economic motivation followed by medium (34.00%) and low (26.00%) economic motivation.

Saravanakumar (1996) conducted a study on mango growers in Krishnagiri taluk of Dharmapuri district of Tamil Nadu and found out that, majority of the respondents (60.83%) had medium economic motivation while 16.67 per cent and 22.50 per cent of the farmers belonged to low and high level of economic motivation, respectively

Chandran (1997) revealed that, 46.66 per cent of tapioca growers in Ernakulam district of Kerala state belonged to medium and economic motivation category.

Sawant (1999) in his study on effect of different modes of presentation of information of mushroom cultivation on Maharashtra state reported that, 78 per cent of respondents belonged to medium economic category.

Nagesh (2006) reported that majority (65.83%) of pomegranate growers in Bagalkot district of Karnataka had medium economic motivation, followed by 15.84 and 18.33 per cent of respondents belonging to low and high economic motivation categories, respectively.

Atul (2008) reported that, 58 per cent of grape exporting farmers of Maharashtra state belonged to medium level of economic orientation categories, followed by high (29%) and low economic orientation category (13%), respectively.

2.2 Extent of knowledge possessed by the horticultural crop growers about post-harvest management practices

Chand and Sharma (1993) noticed that 67.44 per cent of the apple growers in Kulla and Mandi districts of Himachal Pradesh possessed knowledge about pre and post-harvest technology.

The investigation carried out by Bhople *et al.* (1996) in Norkhed Panchayat Samit of Nagpur district of Maharashtra revealed that 62.77 per cent of orange growers had knowledge about grading.

The research study conducted by Ahire *et al.* (1999) on grape growers of Bhokardhan Panchayat Samit of Jalna district in Maharashtra state revealed that stage of harvest, time of harvest and grading and packing of grape was known to 34.66, 26.66 and 26.66 per cent of sample farmers, respectively.

Waman and Patil (1998) found that all the onion growers of Yeola tahsil of Nasik district in Maharashtra were better knowers about appropriate stage of harvesting for storage purpose. The knowledge of cutting bulbs leaving 2 cm neck length was noticed with 80.66 per

cent of respondents. Less than 50.00 per cent of the respondents had knowledge about identification of various pests and diseases (42.00%) and control measures for these pests and diseases (36.00%) during storage period of onion produce. However, very less percentage of respondents possessed knowledge about curing of bulb (16.66%), improved method of storage (14.00%) and implements for harvesting (10.00%).

It was noticed from the findings of Mehta *et al.* (2000) that around three-fourth of minor fruit crops growing respondents (62.00%) in Sindhdurg district of Konkan region had medium knowledge about post-harvest technology, whereas low and high level knowledge about post-harvest technology was noticed with 22.00 and 16.00 per cent, respectively. But, majority of the respondents did not possessed knowledge about equipments for testing of TSS (67.00%), purposes of using preservatives (66.00%) and preservatives used in processing (57.00%).

A study carried out by Achut Raju *et al.* (2002) in Guntur district of Andhra Pradesh, revealed that all the beetlevine growers had the knowledge of packing beetlevine followed by the practice of grading (95.00%) and harvesting (87.50%).

Moulasab (2004) conducted a study on mango growers of Northern Karnataka and reported that 25.00 per cent of respondents possessed the knowledge of mechanical harvesting and only 12.50 per cent were aware of mechanical means of sorting and cleaning of mangoes. The knowledge about means of transportation and mango packing was known to all the farmers and 81.66 per cent were knowing cold storage followed by knowledge about processing of mango to make juice (58.33%), but only 23.33 and 20.83 per cent had the knowledge about scientific grading and packing, respectively.

Sunil Kumar (2004) found that a high per cent of tomato growers in Belgaum district of Karnataka had the knowledge about the manual sorting (86.66%), manual grading (70.00%), bamboo basket packing (74.16%), whereas, knowledge about possessing of tomato was noticed with 55.00 per cent, respondents.

2.3 Extent of adoption of improved post-harvest management practices among horticultural crop growers

Chand and Sharma (1993) noticed that the adoption of pre and post-harvest technology in apple was noticed with 41.44 per cent of sample farmers in Kulla and Mandi districts of Himachal Pradesh.

Venugopal Reddy and Ratnakar (1993) undertaken the study on adoption of mango post harvest technology in Khamman district of Andhra Pradesh and observed that majority (88.33%) of growers were found to pack fruits by using paddy straw as cushion material, but only a few number (4.17%) were using wooden crates as package material. All the farmers were not adopting the recommended method of fruits storage, but recommended time of harvesting was noticed among 71.77 per cent farmers.

Chikhale *et al.* (1998) conducted a study in Amaravati district of Maharashtra state on adoption of post-harvest management practices by orange growers. The data depicted that 25.00 per cent of respondents were following recommended practices to control decaying of fruits.

The study undertaken by Deshmukh *et al.* (1998) in Aurangabad district of Marathwada region reported that nearly 60.00 per cent of custard apple growers were following recommended harvesting practices.

According to Waman and Patil (1998), almost all the onion growers of Yeola tehsil of Nasik district in Maharashtra were found to harvest onion crop at appropriate stage, followed by recommended storage practice (85.33%)

The study carried by Kubde *et al.* (2000) revealed that adoption of storage practices among potato growers in Ambegaon Panchayat Samiti of Pune district in Maharashtra and reported that 83.00 per cent of cultivators were adopted recommended storage method and about 71.00 per cent of farmers were practicing precautionary measures during storage of potato. But none of the growers were using chemicals to control the sprouting during storage.

The study conducted on onion crop growers in Khatav tehsil of Maharashtra by Palande *et al.* (2001) reported that 40.00 per cent of respondents followed proper timing of harvesting, while 38.33 per cent respondents had the practice of with holding irrigation three weeks before harvesting as recommended and 28.33 per cent of the respondents adopted neck topping. Whereas, only 8.34 per cent of respondents adopted application of MH-40 (Malichydrazine) before 20 days of harvesting.

The study carried by Govinda Gowda and Narayana Gowda (2004) in Bijapur and Bangalore rural districts of Karnataka on adoption of sustainable post-harvest management practices in grape, highlighted that 65.00 per cent of small grape cultivators around 40.00 per cent of other growers of Thompson seedless were found to store their produce in community based cold storage units. However, cent per cent of respondents were using correct packing materials to pack their produce. Further, the study highlighted that nearly 90.00 per cent of farmers prepared their raisins by chemical dipping method, whereas only few farmers (11.00%) adoption sulphur fumigation method for raisin preparation.

Moulasab (2004) in the study on adoption of improved post harvest management practices by mango growers of North Karnataka indicated that only 15.00 per cent of the sample farmers followed hand sorting. Whereas, very few mango growers were found to use paper bag (4.10%), trace/porous packaging (6.66%) and recommended grading method (6.66%).

Selvarani and Manoharan (2004) observed that the practice of separating pest and disease attacked potato tubes and recommended method of storage was noticed among 70.83 and 25.00 per cent of sample farmers respectively in tribal area of Nilgiris district.

Sunil Kumar (2004) conducted a study on adoption of post harvest management practices by tomato growers of Belgaum district and noticed that two-third of respondents (66.67%) were found to adopt manual sorting followed by practices of manual grading among 46.67 per cent of farmers. However, cent per cent of respondents had the practice of packing tomato produce in bamboo basket.

2.4 Relationship of entrepreneurial characteristics with knowledge and adoption of post-harvest management practices in horticultural crops

Relationship of entrepreneurial characteristics with knowledge

Independent variable / Name of the researcher	Place of study	Type of respondents	Nature of relationship
Risk orientation			
Vedamurthy (2002)	Shimoga district of Karnataka	Arecanut growers	Non-significant
Sundar Sharma (1993)	Kolar district of Karnataka	Mango growers	Significant
Venugopal Reddy and Ratnakar (1993)	Nasik district of Maharashtra	Onion growers	Significant
Economic motivation			
Pandya and Venkaria (1994)	Surat district of Gujarat state	Banana cultivators	Significant
Srinivas Reddy (1995)	Kolar district of Karnataka state	Mango growers	Non-significant
Saravanakumar (1996)	Dharmapuri district of Tamil Nadu	Mango growers	Non-significant
Birajdar (1999)	Akola district of Maharashtra	Grape growers	Positively significant

Thippeswamy (2007)	Chitradurga district of Karnataka	Coconut growers	Positively significant
Achievement motivation			
Kantharaju (1989)	Hassan district	Coffee and cardamum growers	Non-significant
Raghavendra (1997)	South Canara district of Karnataka	Arecanut growers	Highly significant

Relationship of entrepreneurial characteristics with adoption

Risk orientation			
Kumbar (1983)	Bijapur district of Karnataka	Grape growers	Non-significant
Pathak (1992)	Akola district of Maharashtra state	Flower growers	Significant
Kadam and Borse (1993)	Jalagaon district of Maharashtra	Banana growers	Significant
Lianbika and Nikhade (1993)	Mizoram	Pineapple growers	Significant
Singha (1996)	Kamrap district of Assam	Coconut growers	Significant
Kumar (1998)	Bijapur district of Karnataka	Banana growers	Non-significant
Ajay Kumar (1989)	Ranga Reddy district of Andhra Pradesh	Grape growers	Significant
Lokhande and Wangikar (1991)	Mizoram	Grape growers	Significant
Gotyal (2007)	Bijapur district of Karnataka	Grape growers	Non-significant
Economic motivation			
Ramesh Babu (1987)	Bangalore and Kolar districts	Grape growers	Significant
Gotyal (2007)	Bijapur district of Karnataka	Grape growers	Significant
Thippeswamy (2007)	Chitradurga district of Karnataka	Coconut growers	Positively significant
Achievement motivation			
Ajay Kumar (1989)	Ranga Reddy district of Andhra Pradesh	Grape growers	Significant
Kantharaju (1989)	Hassan district of Karnataka	Coffee and cardamum growers	Non-significant

2.5 Constraints faced by horticultural crops grower in adoption of improved post-harvest management practices

Abdul and Kaul (1988) reported that, the main constraints in marketing of pineapple in almost all districts of Meghalaya state were fluctuating marketing price, heavy cost of transportation and substantial wastage during transportation.

Ajay Kumar (1989) in his study on grape growers in Rangareddy district of Andhra Pradesh reported that, lack of regulated markets was the major constraint faced by the respondents, followed by low price of produce, lack of storage facilities and lack of proper transport facilities.

Lokhande and Wangikar (1991) conducted a study in Omerga taluk of Osmanabad district in Maharashtra and reported that, majority of the grape growers (79.16%) were not able to get improved varietal cuttings, 70.83 per cent of them expressed the problem of less resistance to pest and diseases and 75.00 per cent expressed non-availability of loans from bank in time.

Jayale (1992) in his study on horticulture crop growers observed that, majority of the respondents (79.16%) opined that filling of pit with manure and fertilizers is costly and laborious, while, 66.66 per cent of respondents expressed that, the problem of digging the standard size pit is expensive and forty five per cent of the respondents expressed that, getting seedling is difficult.

Shaikh *et al.* (1993) revealed that, farmers were facing many problems in the adoption of custard apple production technology, of which 24.00 per cent of farmers reported fluctuations of market price and exploitation by middlemen. As regard to the extension service, 76.00 per cent of growers felt that training classes, discussion and mela were not organized by government agency though there was a great need for organizing training classes, holding discussion and mela.

Bhogal (1994) conducted a study in Nainital district of Uttar Pradesh and reported that, 66.66 per cent of the apple growers were facing problems of non availability of cold storage facilities, 61.00 per cent of the apple growers were facing problem of high marketing cost and 51.39 per cent were facing the problem of lack of transport facilities.

Pamer *et al.* (1994) reported that, spoilage was the major problem (68.46%) during marketing of vegetables in South Gujarat, followed by malpractices in weighment (49.41%), lack of credit facilities (24.40%) and inadequate transportation facilities (23.81%).

Sharma *et al.* (1995) in their study on marketing of vegetables in Himachal Pradesh reported that, costly wooden boxes, time consuming manual grading, distant markets, high transportation charges, malpractices in the market and lack of market information were the major problems faced by growers in storage, transportation and marketing of vegetables.

Srinivas Reddy (1995) conducted a study in Kolar district of Karnataka on mango growers and reported that, problem faced by mango growers were more pest and disease incidence, high cost of fertilizer, high cost of plant protection chemicals, non-availability of labour, lack of technical guidance, rain during harvest and problem of weed.

Saravanakumar (1996) conduced a study on mango growers in Dharmapuri district of Tamil Nadu and reported that, majority of the respondents faced the problems like lack of technical guidance (82.50%), inadequate irrigation facilities (70.00%), non-availability of labour (61.67%) and low price for the produce (60.83%).

Sharma (1997) conducted a study on mango growers and reported that, one fourth of the respondents (25.00%) each were facing problem of high cost of fertilizer and weedicide, high cost of nursery plants (24.00%) and lack of technical knowledge in application of fertilizer (22.50%).

Vijayakumar (1997) in his study in Bangalore district observed that, the problems faced by rose growers of Bangalore district were lack of storage facilities, inadequate local markets and exploitation by wholesalers.

Kumar (1998) in his study on banana growers in Bangalore district reported that, the farmers faced the problems like technical guidance, pests and disease, high investment, low price for the fruits, fluctuation in the prices and exploitation by the middleman.

Narappanavar and Bavur (1998) examined the problems in storage, transportation and dissemination of market information in potato, marketing in Dharwad district of Karnataka state. The results of the study revealed that, farmers were not facing severe problems in transportation because of large number of tractors in the village. Similarly, farmers were making suitable arrangements for storage of potato on the farm itself.

Anis Mohammed *et al.* (1999) found that lack of storage facilities, unavailability of preservation industries in the area, perishable commodity results in economic losses, chances of theft, high mortality of plants during initial stages and lack of technical know-how were the priority and important constraints experienced by Mandarien growers.

Atibudhi (1999) reported that, the capital available with small and marginal farmers was not adequate to meet the production expenses, some of them were forced to depend upon commission agents for arranging transportation, packing etc in Cuttack district of Orissa. This enabled the commission agents to cheat the innocent cultivators by charging exhorbitant prices for such facilities. Therefore, it is necessary to provide the credit for marketing operations by treating as a part of cost of cultivation.

Vasudev and Choudhary (1999) observed that the lack of grading facilities, absence of market information and spoilage and malpractices were the major problems in productions and marketing of tomato in the regions of Andhra Pradesh. They have concluded that providing these facilities can improve the marketing efficiency and will help the farmers in realizing better prices.

Karpagam (2000) conducted a study on turmeric growers of Tamil Nadu state and reported the problems such as price fluctuation, high cost of inputs and scarcity of labour and very few respondents expressed the problem of non-availability of credit.

Govindagowda (2002) in his study on sustainable grape cultivation reported the important constraints in grape marketing as, no fixed price, low price, lack of regulated markets, exploitation by middle men, lack of cold storage facility, no guidance on marketing aspects and lack of transportation facilities. Further, constraints perceived by them in availing credit were non availability of credit in time and inadequate quantity of credit.

Sunil Kumar (2004) in his study on tomato growers in Belgaum district of Karnataka reported that, majority of the farmers (75.83%) faced the problem of technical knowledge and guidance in post-harvest technology. Whereas 65.00 per cent of the respondents faced the problem of high fluctuation in market price, followed by high transportation cost (62.53%), labour shortage and high wages (55.83%) and power shortage (46.66%).

Nagesh (2006) reported that the major constraints faced by pomegranate growers were; lack of storage facility and lack of processing units.

3. METHODOLOGY

The study was conducted during 2008-2009 in Dharwad and Belgaum districts of Karnataka. The research methods and techniques followed in the study are detailed under the following sub heads.

3.1 Research design

3.2 Locale of the study

3.3 Description of the study area

3.4 Selection of villages

3.5 Selection of respondents

3.6 Selection of variables for the study

3.7 Operationalization and measurement of variables

3.8 Constraints faced by mango growers in adoption of improved post-harvest management practices

3.9 Procedure employed in data collection

3.10 Statistical methods used to analyse the data

3.1 Research design

In the present investigation "Ex-post facto design" was used for the study. This design was considered appropriate because, the phenomena had already occurred.

3.2 Locale of the study

The study was conducted in Dharwad and Belgaum districts of Karnataka state as these stood first and second in area and production of mango in North Karnataka.

Among five taluks of Dharwad district, Dharwad taluk had the maximum area under mango (2,618 ha) followed by Kalghatagi (715 ha) taluk. Similarly, among eleven taluks of Belgaum district Khanapur taluk (1,489 ha) had maximum area followed by Belgaum (1,385 ha). Hence, Dharwad & Kalghatagi taluks from Dharwad district and Khanapur and Belgaum taluks from Belgaum district were purposively selected for the study.

3.3 Brief description of the study area

Dharwad district situated in northern transitional zone of Karnataka, is basically malnad area and it consists of five talulks. The district lies between 15^0 19^1 to 15^0 41^1 North latitude and 74^0 43' to 75^0 15 East longitude. This is surrounded by Belgaum in north, Haveri in south, Gadag on east and Uttra Kannada on west. The total population of the district is 16.04 lakhs with literacy rate of 71.87 per cent. The district is in 6^{th} rank.

The total geographical area of the district is 4, 27,329 ha of which 3, 62,855 ha is the net sown area. The major soils range from shallow to medium black and red sandy loam soils and predominantly the district has gravelly black and red loamy soil. The average rainfall of the district is 717 mm of which 90 per cent is recorded during Southwest monsoon (June-Sept) and the rest occurs during summer and winter seasons. The major field crops of the district are cotton, jowar, paddy, potato, ground nut, and vegetables in kharif season, in *rabi* season major crops are *rabi* jower, bengalgram and wheat. Among horticultural crops, mango is the major crop grown in an area of 4115 ha with production of 49038 tones. The average productivity of the district is 31416 tonnes per ha as compared to state average 89000 tonnes per ha.

Belagaum district coming under northern transitional zone of Karnataka, consists of ten taluks *viz*. Athani, Bailhongal, Belgaum, Chikodi, Gokak, Hukkeri, Khanapur, Raibag, Ramdurg and Suadathi. The district lies between 15^0 23' to 16^0 38' North latitude and 74^0 05' to 75^0 28' East longitude. This is surrounded by Maharashtra state in north, Dharwad and Haveri districts in southern side, Bijapur and Bagalkot districts in east and Goa state on the western side.

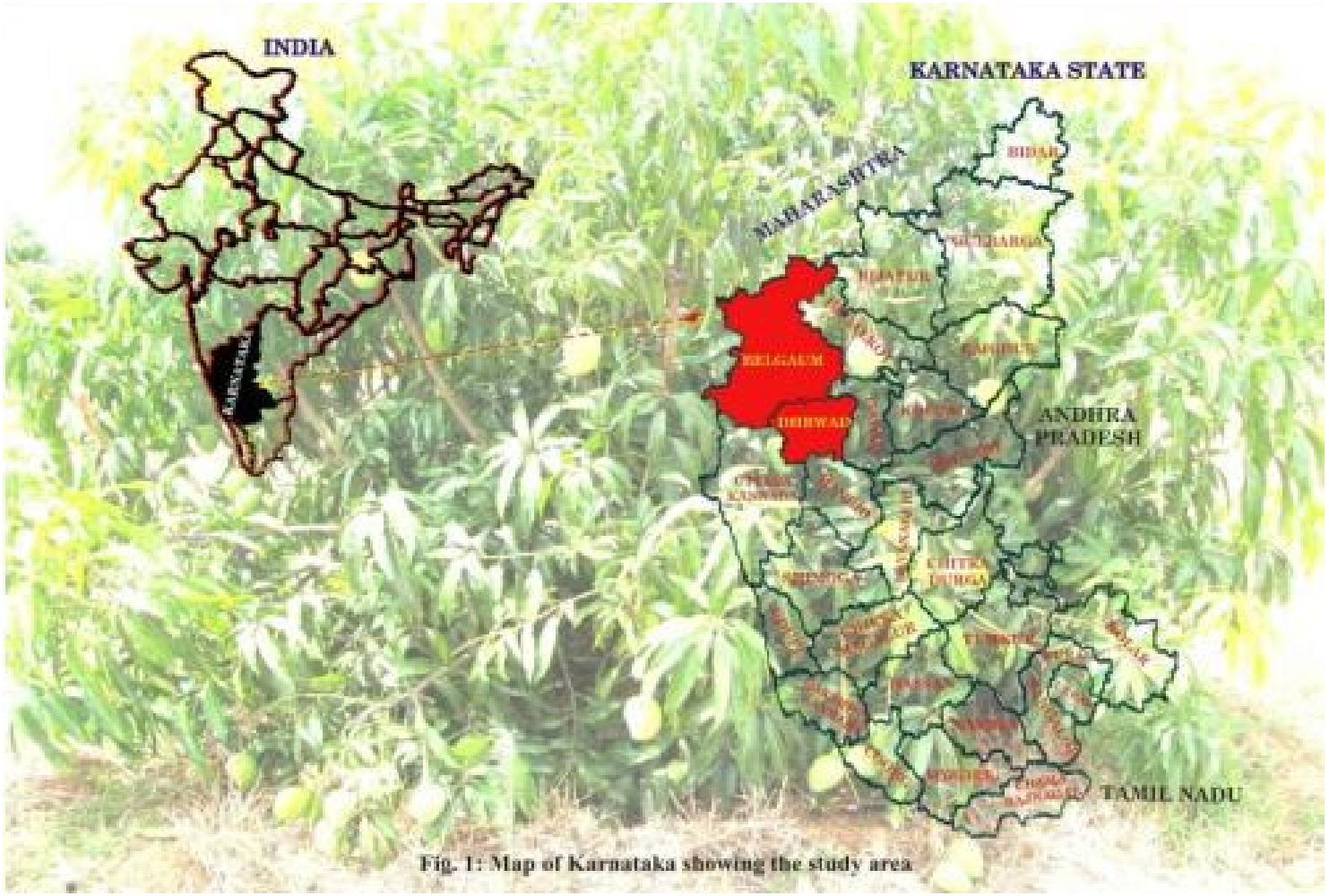


Fig.1. Map of Karnataka showing the study area

Table 1: Area and production of mango in Belgaum and Dharwad districts (2007-08)

Sl. No	District	Taluk	Area (Hectares)	Production (Tonnes)	Yield (Tons/ha)
1	Belgaum	Belgaum	1385	24930	18
		Khanapur	1489	14890	10
2	Dharwad	Dharwad	2618	31416	12
		Kalghatagi	715	8580	12

Source : DDH Offices, Belgaum and Dharwad, 2007-08

The total geographical area of the district is 13, 44,382 ha of which 10,14,549 ha is cultivable area. The average rainfall is 808 mm of which 90 per cent is recorded during southwest monsoon (June-Sept) and the remaining during summer and winter seasons. The major soils of the region are deep clay with light black, reddish sandy and red sandy loam soil. The Ghataprabha and Malaprabha canals are the main irrigation source in this area. Maize, groundnut, sunflower and wheat are the major food crops grown included fruits and vegetables, and sugarcane etc. The district ranks 12th in growing of fruits and vegetables. Among the fruits grown, mango is grown on an area of 3964 ha with a production of 50673 tons (Anon., 2009).

3.4 Selection of villages

The list of villages having highest area under mango crop in Dharwad, Kalgatagi, Belgaum and Khanapur taluks was obtained from Horticulture Department. Considering the highest area under mango cultivation, the list of villages was prepared. From this, three villages for each taluk were selected based on maximum area under mango crop. The list of villages selected from each taluk for the study is given in the Table1.

Table 2: List of villages selected for the study

Districts	Taluks	Name of the selected Villages
1. Dharwad	1. Dharwad	1. Navloor 2. Jogiyellapur 3. Kelageri
	2. Kalagatagi	1. Hirehonalli 2. Doomwad 3. Kurvinkoppa
2. Belgaum	1. Belguam	1. Santibasavada 2. Navagi 3. Kinagi
	2. Khanapur	1. Beedi 2. Itagi 3. Bekawada

3.5 Selection of respondents

The list of established mango orchards for each of the 12 selected villages was prepared in consultation with officers of state Department of Horticulture and people involved in procurement and processing of mango. Based on random sampling, ten mango growers were selected from each of selected village to constitute a sample of 120 mango growers.

3.6 Selection of variables for the study

3.6.1 Dependent variables

In the light of objectives set for the study the dependent variables considered were;

1. Knowledge level of post harvest management practices in mango, and
2. Adoption of post harvest management practices in mango

3.6.2 Independent variables

Based on the review of literature and discussion with the scientists of UAS, Dharwad and Extension functionaries of Department of Horticulture, the following independent variables were selected for the study.

1. Education
2. Land holding
3. Farming experience
4. Experience in mango cultivation
5. Mass media use
6. Risk Orientation
7. Extension participation
8. Achievement motivation
9. Economic motivation

3.7 Operationalization and measurement of variables

3.7.1 Dependent variables

3.7.1.1 Knowledge level

Knowledge level of the post harvest management practices was operationally defined, as the extent to which the mango post harvest techniques were known to the respondents.

For the present study, “Teacher made knowledge test” was developed covering recommended post harvest of practices and consulting experts in mango cultivation. Totally nine items *viz*., harvesting, pre and post harvest treatment, grading and sorting, storage, packing, ripening, transportation, processing and control of storage pests and diseases were identified. Under these items, 50 detailed practices were developed in the form of questions to obtain the response from respondents. The answers were quantified by giving one score to the correct answer and zero score to the incorrect one. The total knowledge score for individual respondent was calculated by summing up the number of items correctly answered. As a result, the maximum score that one could get was 50 and the minimum was zero. After computing knowledge level score, the respondents were grouped in to low, medium and high categories based on the mean and 0.425 standard deviation as shown below.

Knowledge category	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.7.1.2 Adoption of post harvest management practices in mango

Adoption was operationally defined as the extent to which the respondents adopted improved post harvest techniques in the mango crop.

Based on the recommended practices and in consultation with scientists and specialists working in mango crop, eight areas of post harvest practices were identified for measuring the adoption level of post harvest management practices. And 20 practices were framed for the measurement. The scores for each of the individual practices adopted were arrived at by viewing the relative importance of the practice and in consultation with the specialists. The following scores were given for full, partial and non-adoption of the recommended practices.

Adoption level	Score
Full adoption of the recommended practices	1.00
Partial adoption of the recommended practices	0.50
Non adoption of the recommended practices	0.00

Thus, the maximum score that an individual respondent could obtain was 20 and the minimum was zero. Depending upon the total score obtained by each of the respondent, the respondents were grouped into three categories taking mean and standard deviation as a measure of check.

Category of adopters	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.7.2 Independent variables

Based on the past research studies and in consultation with experts, the variables which were found directly or indirectly related to knowledge and adoption of post harvest management practices in mango were identified for the study. Variables such as education, land holding, farming experience and experience in mango cultivation, mass media use, risk orientation, extension participation and achievement motivation were selected for the study. The method followed for measurement of quantification of each variable is given below.

3.7.2.1 Education

It is operationalized as the number of years of formal education the respondent has undergone. For each year of schooling, a score of one was given. The scale developed by Trivedi (1963) was used to measure the educational status of the respondent.

Category	Score
Illiterate	0
Primary school	1
Middle school	2
High school	3
Pre-university	4
Graduation	5
Post graduation	6

3.7.2.2 Land holding

Land holding of the individual respondent was expressed in terms of standard dry land acres as suggested by Ministry of Rural Development vide circular No 280-12/16/19-Rural Development-III (Vol-V) dated 15 November, 1991 (Anonymous, 1992).

Land holding category	Area in ha
Marginal farmer	Up to 1 ha
Small farmer	1-2 ha
Semi-medium farmer	2-4 ha
Medium farmer	4-10 ha
Big-farmer	More than 10 ha

3.7.2.3 Farming experience

Farming experience of respondents was determined by the total number of years of experience in cultivation. The experience of the farmer in completed years at the time of investigation was considered and was grouped into three groups by taking mean and S.D as measure of check.

Category	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.7.2.4 Experience in mango cultivation

Experience in mango cultivation refers to number of years a farmers has been cultivating mango. Later, the experiences in mango cultivation in completed years at the time of investigation was considered and were categorized in to less, medium and more experienced groups by taking mean and standard deviation.

Category	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.7.2.5 Mass media utilization

Mass media participation is referred as the degree to which the respondents utilized the different mass media in terms of listening to farm broadcast, viewing telecast and reading newspaper. In the present research, mass media participation of respondents was studied according to their possession and extent of utilizing selected mass media. The possession and subscription of the media was quantified by giving one score each for possession/subscription for each media.

The extent of utilization was measured on three point continuum i.e., regular, occasional and never. The procedure suggested by Trivedi (1963) was followed for measuring mass media use of the respondents.

3.7.2.6 Risk orientation

The risk orientation of the respondent was operationlised as degree to which a farmer is oriented towards risk and uncertainty and has courage to face the problems in post harvest management of mango. The scale developed by Supe (1969) was used to measure risk orientation. The items were rated on a three point continuum ranging from agree, undecided and disagree with the weightage of 3, 2 and 1 for positive statements and 1, 2 and 3 for negative statements respectively. After obtaining the risk orientation for each of the respondents, the respondents were classified into three categories taking mean and S.D as the points of discrimination.

Category	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.7.2.7 Extension participation

Extension participation refers to the extent of participation of farmers in different extension activities conducted during the last one year prior to the time of interview. The following activities were included to determine the extent of participation of respondents.

Sl. No.	Extension activities	Extent of participation		
		Regular	Occasionally	Never
1.	Training programmes	2	1	0
2.	Demonstrations	2	1	0
3.	Field day	2	1	0
4.	Field visits	2	1	0
5.	Extension group meeting/interaction	2	1	0
6.	Agriculture exhibitions	2	1	0
7.	Krishi mela	2	1	0
8.	Educational tour/exposure visits	2	1	0
9.	Others (specify)	2	1	0

3.7.2.8 Achievement motivation

Achievement motivation of the respondents is defined as the degree to excel regardless of social rewards. It is the desire to do well not so much for the sake of social recognition or prestige, but to attain an inner feeling of personal accomplishment.

The achievement motivation scale developed by Singh (1978) was used in the present study. The scale had six statements with three alternative answers each. The statements were rated on a three point continuum ranging from high, medium and low with weightage of 2, 1 and 0 for positive statements and 0, 1 and 2 for negative statements respectively. And the respondents were categorized as low, medium and high taking mean (x) and standard deviation (SD) as measures of check.

Category	Score
Low	Below (Mean – 0.425 SD)
Medium	(Mean - 0.425 SD to Mean +0.425 SD)
High	Above (Mean + 0.425SD)

3.8 Constraints faced by mango growers in adoption of improved post-harvest management practices

To know the problems faced by the respondents in adoption of post-harvest technology, the respondents were asked to indicate the problems under the detailed items and thus, responses were recorded. Later, the obtained responses were enlisted and expressed in terms of frequency and percentage.

3.9 Procedure employed in data collection

3.9.1 Pre-testing of interview schedule

Keeping in view the objectives and variables under study, a structured interview schedule was prepared by reviewing the previous research studies, consulting and discussing with the experts and professional workers in the field of agricultural extension, agricultural

engineering and state department of Horticulture. The questionnaire was pre-tested in a non-sample area. The finalized interview schedule was prepared after inserting necessary modifications, additions and deletions based on pre-tested results. The final format of the interview schedule was used for collecting responses from each respondent in an informal atmosphere by personal interview method.

3.10 Statistical methods used to analyse the data

The data collected from the respondents was scored, tabulated and analyzed by using suitable statistical tools such as frequency, percentage, mean, standard deviation and correlation. Finally the appropriate inferences were drawn at each level of interventions to arrive the final results.

4. RESULTS

The results are presented under the following headings in accordance with the objectives of the study.

4.1 Entrepreneurial characteristics of mango growers

4.2 Extent of knowledge possessed by mango growers about post harvest management practices in mango

4.3 Extent of adoption of improved post-harvest management practices

4.4 Relationship between entrepreneurial characteristics of respondents with knowledge and adoption of improved post-harvest management practices

4.5 Constraints faced by mango growers in adoption of improved post harvest management practices

4.1 Entrepreneurial characteristics of mango growers

4.1.1 Personal characteristics of mango farmers

The results pertaining to personal characteristics of mango growers have been depicted in Table 3 and Fig. 2.

Education

In distribution of education level, moderate number (28.33%) of respondents studied upto middle school followed by high school and primary school education with 21.67 per cent and 16.67 per cent of respondents, respectively. The education upto Pre-University and graduation level was noticed with 11.67 and 8.33 per cent of the respondents, respectively. But, 13.33 per cent of the respondents were noticed to be illiterate.

Land handling

The result shows that around one-third of respondents (34.17%) were small farmers followed by semi-medium farmers (31.67%), whereas, medium farmers and marginal farmers were observed to the extent of 21.66 and 8.33 per cent respectively. And very less percentage (4.17%) belonged to big land holding category.

Farming experience

The distribution of farming experience revealed that one-third (53.34%) of farmers had medium farming experience of 21.94 to 34.16 years. Low experience of less than 21.94 years was observed with 28.33 per cent. Whereas, 18.33 per cent of the respondents belonged to high farming experience.

Experience in mango cultivation

The results revealed that, 35.00 per cent of the respondents belong to medium farming experience in mango cultivation of 14.08 to 18.62 years, followed by experience of more than 18.62 years with 33.33 respondents. Whereas, 31.67 per cent of respondents belonged to less experience category of less than 14.08 years.

4.1.2 Mass media utilization

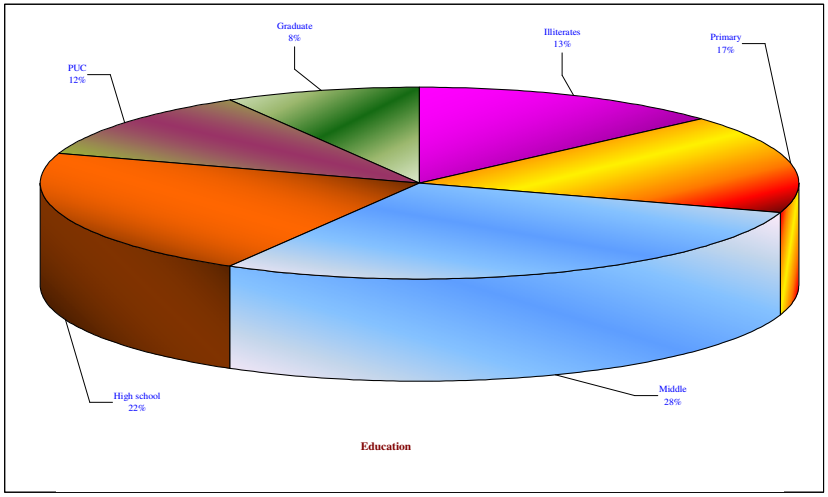
The data pertaining to mass media utilization pattern by the respondents as depicted in Table 4, highlight that the television was the most popular mass media possessed by 90.83 per cent of the respondents, out of which 50.00 per cent viewed programme occasionally, while 36.67 per cent of them were regular viewers. Remaining 13.33 per cent of them never viewed television.

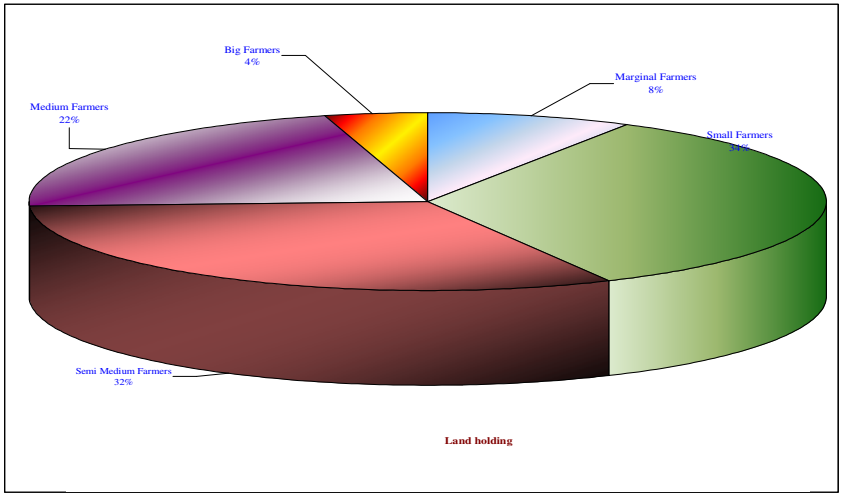
The subscription of newspaper was observed with 59.17 per cent of the respondents. And the utilizing pattern shows that 53.33 per cent were found to read newspapers regularly, while 25.83 per cent of them were occasional readers. But, 20.83 per cent of them never read newspaper.

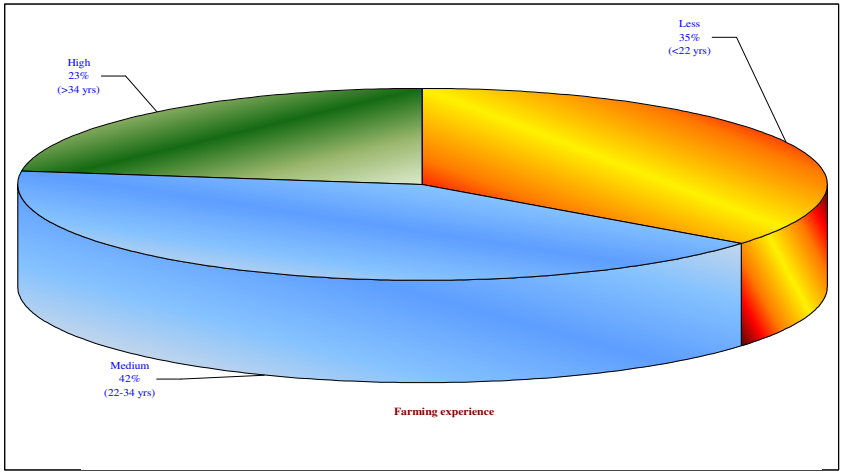
Table 3: Distribution of respondents based on their personal characteristics

(n = 120)

Sl. No.	Characteristics	Number	Per cent
1.	Education		
	Illiterates	16	13.33
	Primary (1-4th standard)	20	16.67
	Middle (5-7th standard)	34	28.33
	High school (8-10th standard)	26	21.67
	Pre-University (11-12th standard)	14	11.67
	Graduate (above 12th standard)	10	8.33
2.	Land holding		
	Marginal Farmers (up to 1 ha)	10	8.33
	Small Farmers (1 - 2 ha)	41	34.17
	Semi Medium Farmers (2-4 ha)	38	31.67
	Medium Farmers (4-10 ha)	26	21.66
	Big Farmers (above 10 ha)	5	4.17
3.	Farming Experience		
	Less (<21.94 years)	34	28.33
	Medium (21.94 - 34.16 years)	64	53.34
	High (>34.16 years)	22	18.33
4.	Experience in mango cultivation		
	Less (<14.08 years)	38	31.67
	Medium (14.08 - 18.62 years)	42	35.00
	High (>18.62 years)	40	33.33







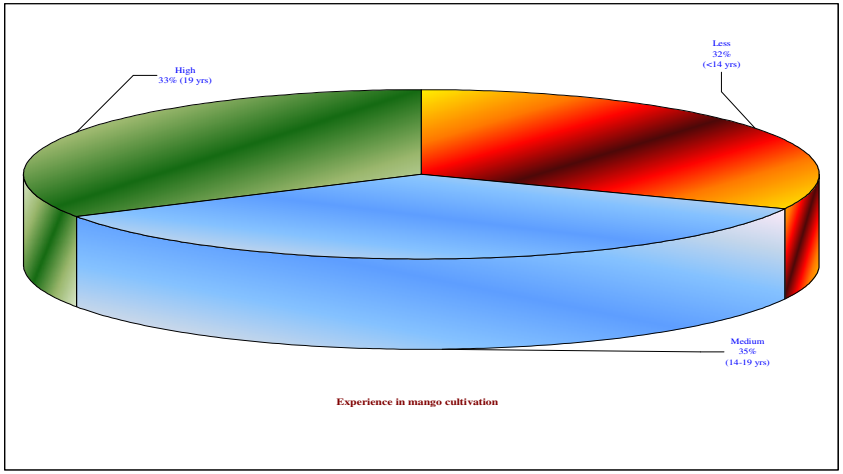


Fig.2. Distribution of respondents based on their personal characteristics

The companion medium radio was possessed by 45.00 per cent of the respondents, out of which 34.17 per cent were listening the radio programme regularly. And 26.67 per cent of them were occasional listeners, whereas 39.17 per cent of them never listened radio.

Farm magazines were subscribed by 17.50 per cent of the respondents of which 16.67 per cent of respondents were regular readers while 6.67 per cent of the respondents noticed to be occasional readers. But, 76.67 per cent of them never read farm magazines.

4.1.3 Extension participation

The results presented in Table 5 depict that comparatively by high per cent of respondents (67.50%) were found to participate regularly in Krishimela. The regular participation in field day and field visits was observed with 35.00 and 30.83 per cent of farmers, respectively. Similarly, participation in agriculture exhibition (28.33%), demonstrations (21.67%) and training programmes (20.83%) was observed to the moderate level. Whereas, participation in extension group meeting (11.66%) and educational tour (9.17%) was noticed to less extent.

4.1.4 Risk orientation

Fifty per cent of respondents belonged to medium risk orientation category (Table 6), whereas, one-fourth of sample farmers possessed low risk orientation and (25.83%) followed by high risk orientation (24.17%).

4.1.5 Achievement motivation

The results of the Table 7 revealed that, around two-third of respondents (64.16%) belong to medium achievement motivation category, whereas low level of achievement motivation was noticed with only 19.17 per cent of respondents but, 16.67 per cent of the respondents had high achievement motivation.

4.1.6 Economic motivation

The distribution of sample farmers in economic motivation (Table 8) highlight that 37.50 per cent belonged to medium economic motivation category, followed by high level of economic motivation with 32.50 per cent of sample farmers. Lastly, 30.00 per cent of respondents were found to noticed in low economic motivation category.

4.2 Extent of knowledge possessed by respondents about post harvest management practices in mango

4.2.1 Distribution of respondents in the overall knowledge about post harvest management practices in mango

A perusal of data in Table 9 indicates the overall knowledge of respondents about post harvest management practices in mango. It was observed that medium level of knowledge was noticed with 45.00 per cent of respondents, while 33.33 per cent had low knowledge level. However, high level of knowledge was noticed with 21.67 per cent of respondents.

4.2.2 Knowledge of individual post harvest management practices

The details of individual post-harvest management practices and the extent of knowledge among the sample farmers (Table 10 and Fig. 9a) has been presented under the following headings.

4.2.2.1 Harvesting practices

It was noticed that cent per cent of mango growers had knowledge about use of grafted plants and use of picking pole for harvesting. Similarly, a high per cent of respondents had knowledge about identifying the maturity of fruits (95.83%), duration taken for maturity of fruits (93.33%) and ideal time of harvesting (87.50%). Fifty per cent of sample farmers possessed the knowledge about identifying the maturity of fruits by using water solution. Whereas, knowledge about noticing variation in maturity of fruits and use of chemical to reduce post-harvest losses was noticed with 30.00 and 23.30 per cent of respondents, respectively

Table 4: Distribution of respondents based on their mass media utilization pattern

(n = 120)

Sl. No.	Mass media	Possessed /subscribed		Utility pattern					
				Regular		Occasional		Never	
		No.	%	No	%	No.	%	No	%
1.	Radio	54	45.00	41	34.17	32	26.67	47	39.17
2.	Television	109	90.83	44	36.67	60	50.00	16	13.33
3.	News Paper	71	59.17	64	53.33	31	25.83	25	20.83
4.	Farm magazine	21	17.50	20	16.67	8	6.67	92	76.67

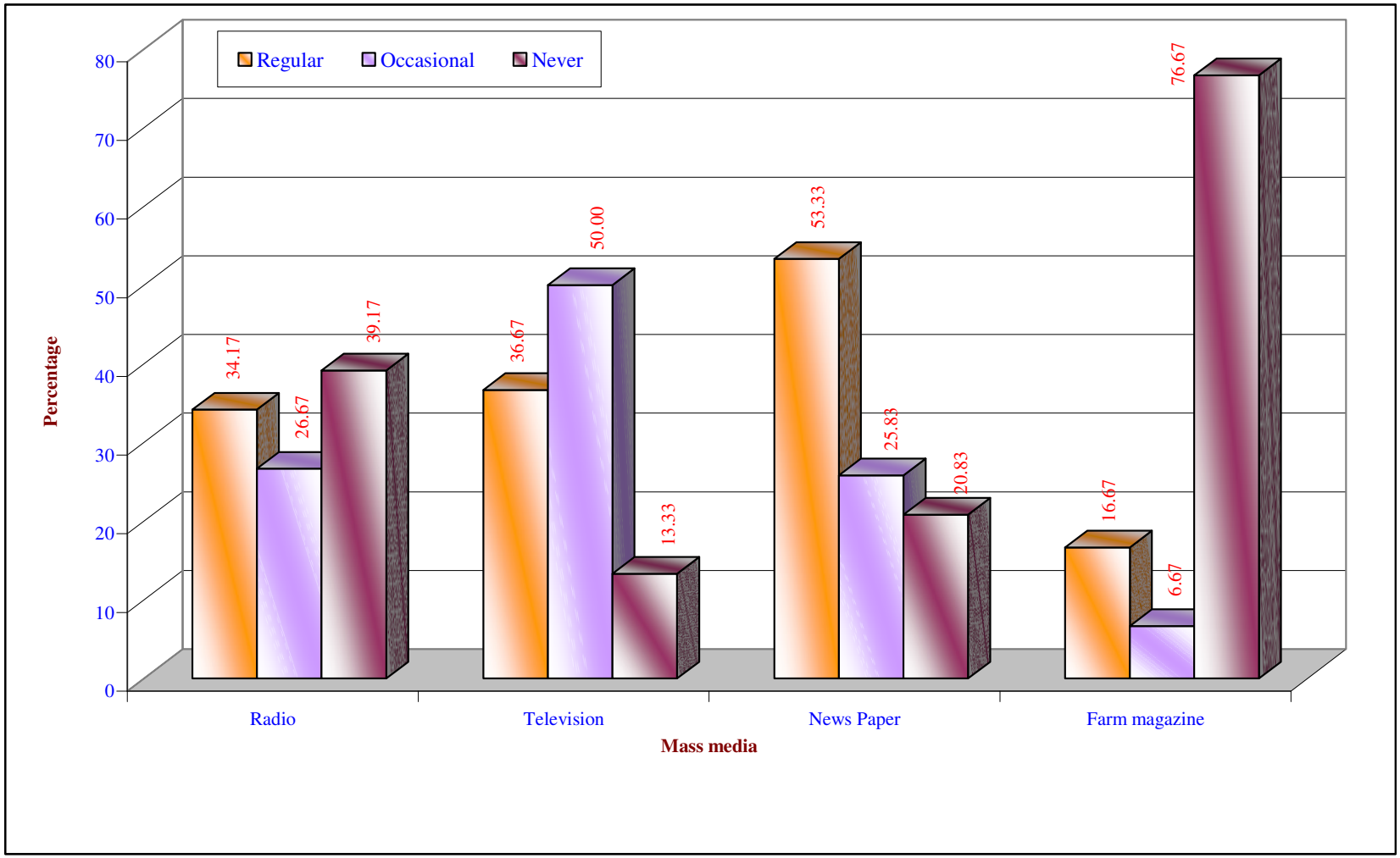


Fig. 3: Distribution of respondents based on their mass media utilization pattern

Table 5: Distribution of respondents based on their extension participation

(n = 120)

Sl. No.	Extension activities	Extent of participation					
		Regular		Occasional		Never	
		No.	Per cent	No.	Per cent	No.	Per cent
1.	Training programme	25	20.83	59	49.17	36	30.00
2.	Demonstration	26	21.67	42	35.00	52	43.33
3.	Field day	42	35.00	38	31.67	40	33.33
4.	Field visit	37	30.83	51	42.50	32	26.67
5.	Extension group meeting /interaction	14	11.67	51	42.50	55	45.83
6.	Agriculture exhibitions	34	28.33	45	37.50	41	34.17
7.	Krishimela	81	67.50	30	25.00	09	7.50
8.	Educational tour /exposure visits	11	9.17	32	26.67	77	64.17

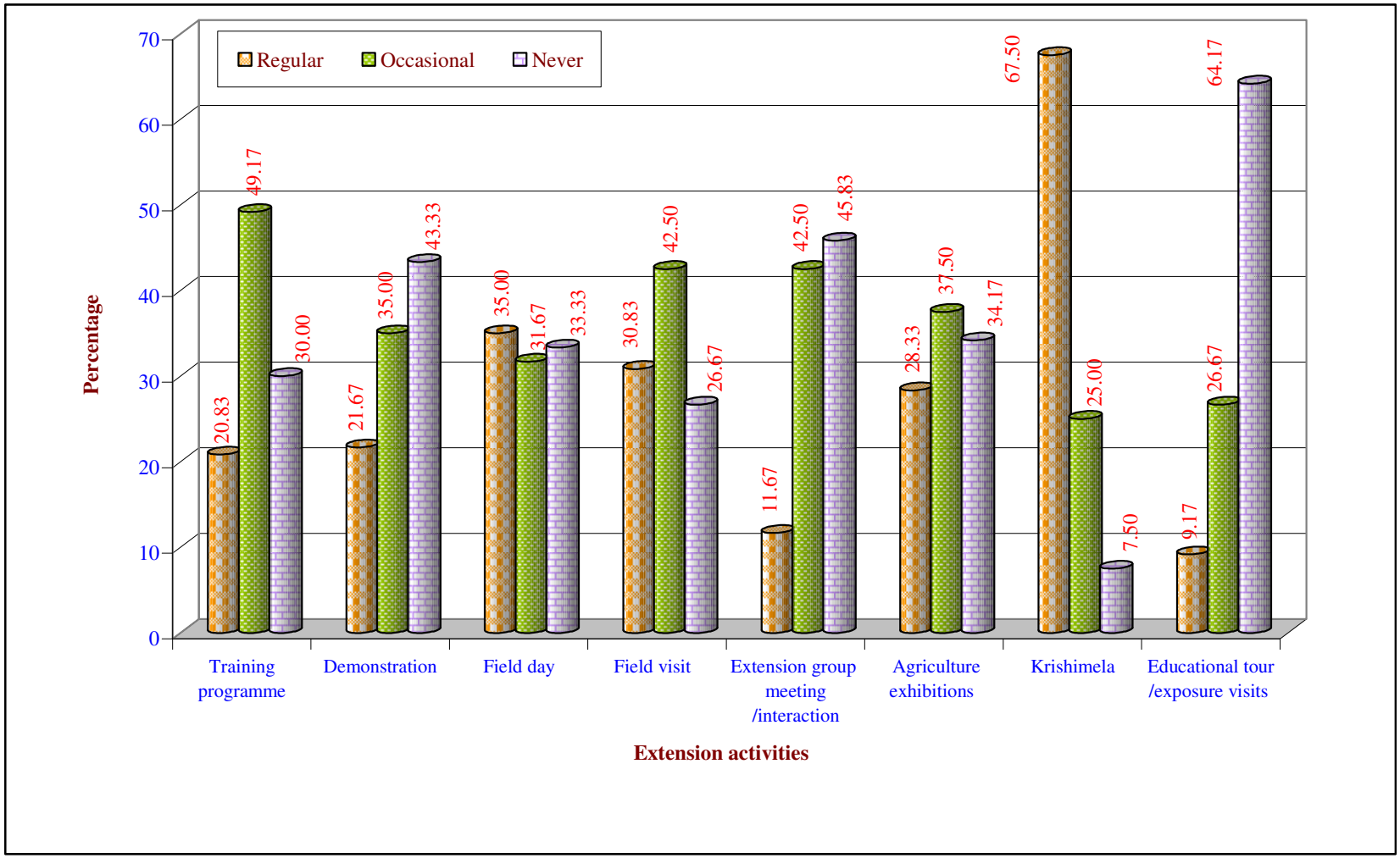


Fig. 4: Distribution of respondents based on their extension participation

Table 6: Distribution of the respondents according to their risk orientation

(n = 120)

Sl. No.	Category	Number	Per cent
1	Low (≤2.86)	31	25.83
2	Medium (2.86-4.03)	60	50.00
3	High (≥4.03)	29	24.17
	Mean	3.44	
	SD	1.37	

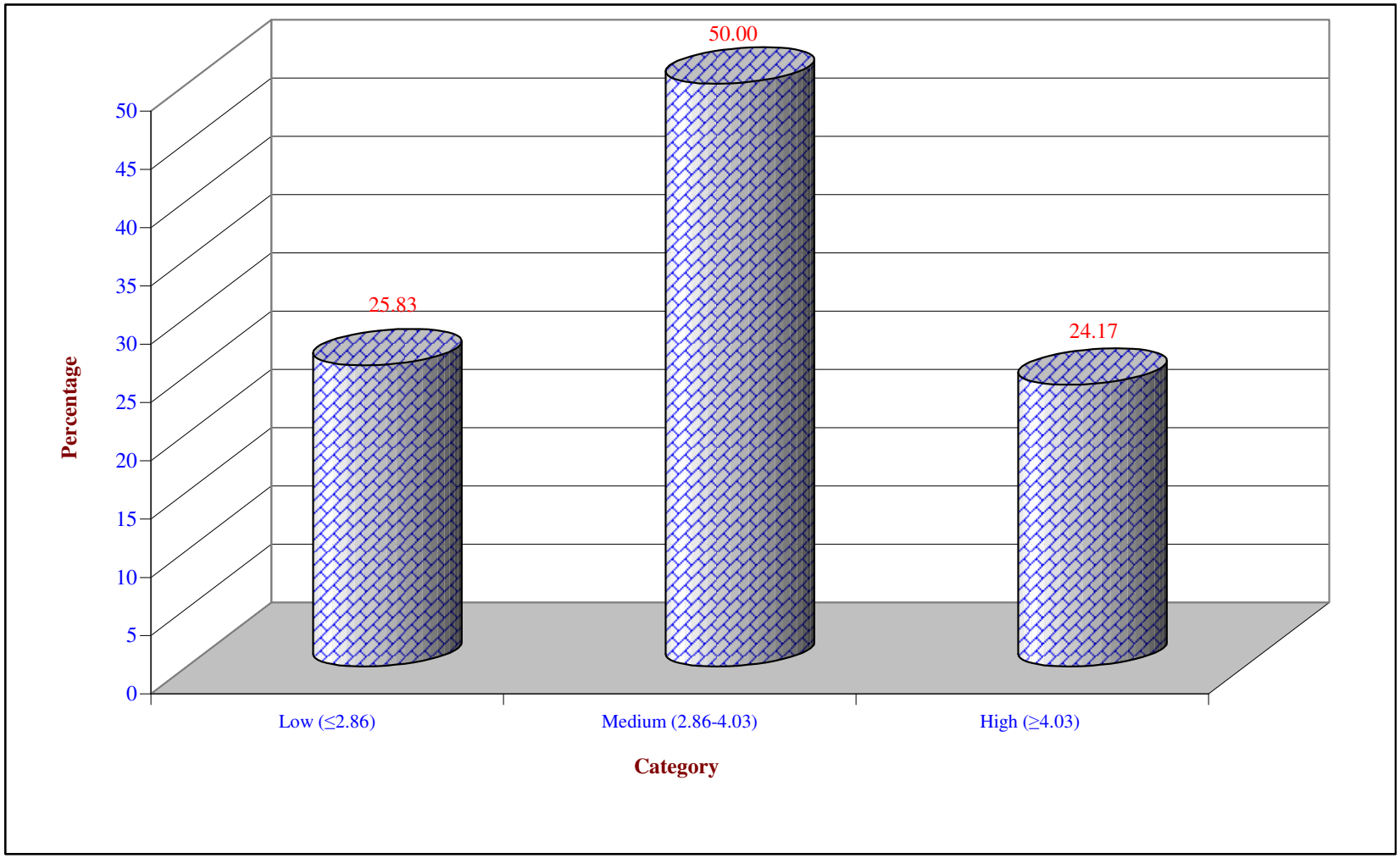


Fig. 5: Distribution of the respondents according to their risk orientation

Table 7: Distribution of respondents based on their achievement motivation

(n = 120)

Sl. No.	Category	No.	Per cent
1	Low (≤4.91)	23	19.17
2	Medium (4.91-6.19)	77	64.16
3	High (≥6.19)	20	16.67
	Mean	5.55	
	SD	1.50	

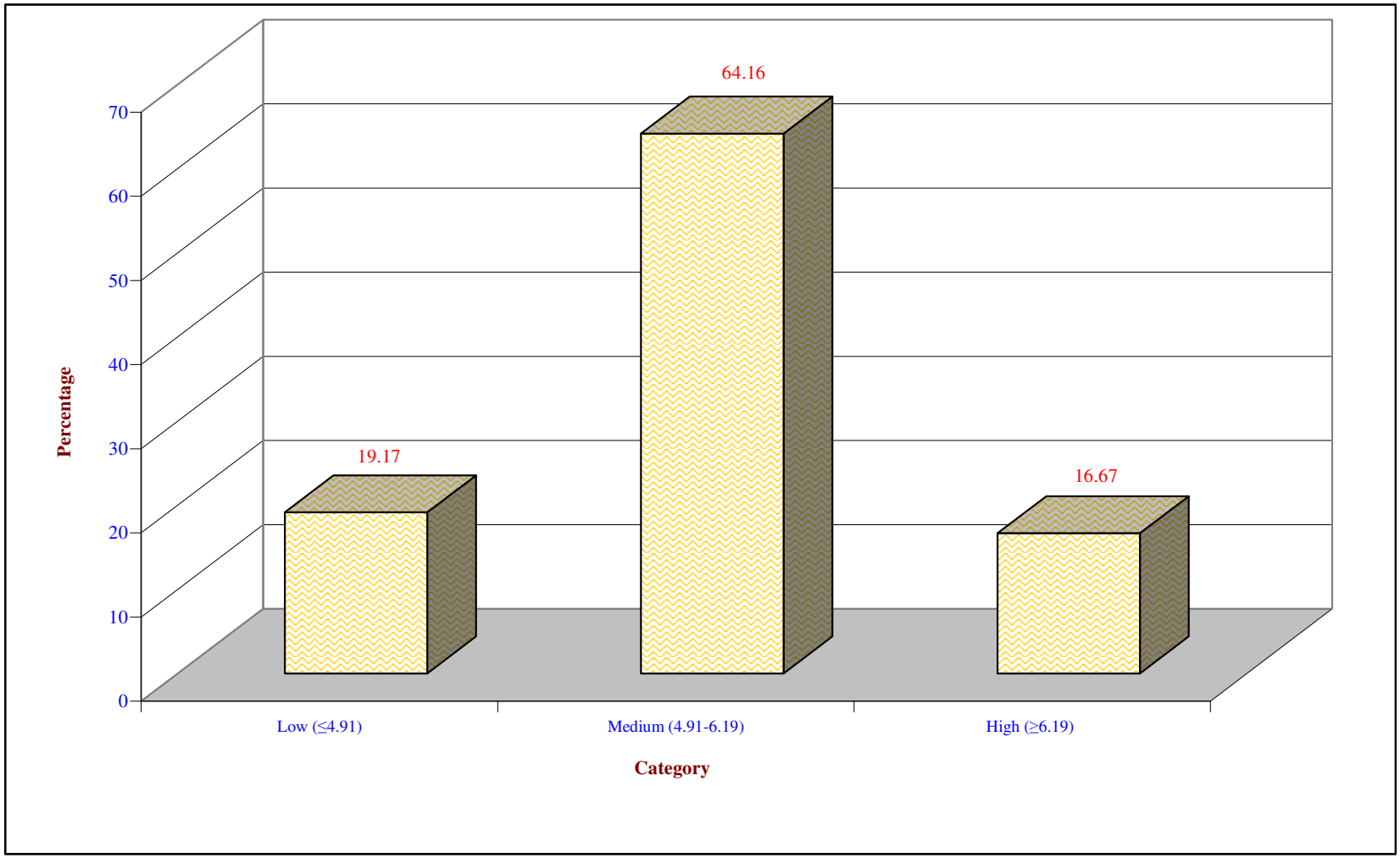


Fig. 6: Distribution of the respondents according to their achievement motivation

Table 8: Distribution of respondents based on their economic motivation

(n = 120)

Sl. No.	Category	No.	Per cent
1	Low(<15.68)	36	30.00
2	Medium(15.68-20.12)	45	37.50
3	High(>20.12)	39	32.50
	Mean	17.90	
	SD	5.23	

Table 9: Distribution of respondents based on the overall knowledge level of the post harvest management practices in mango

(n = 120)

Sl. No.	Category	No.	Per cent
1	Low (≤22.52)	40	33.33
2	Medium (22.52-28.40)	54	45.00
3	High (≥28.40)	26	21.67
	Mean	25.46	
	SD	6.91	

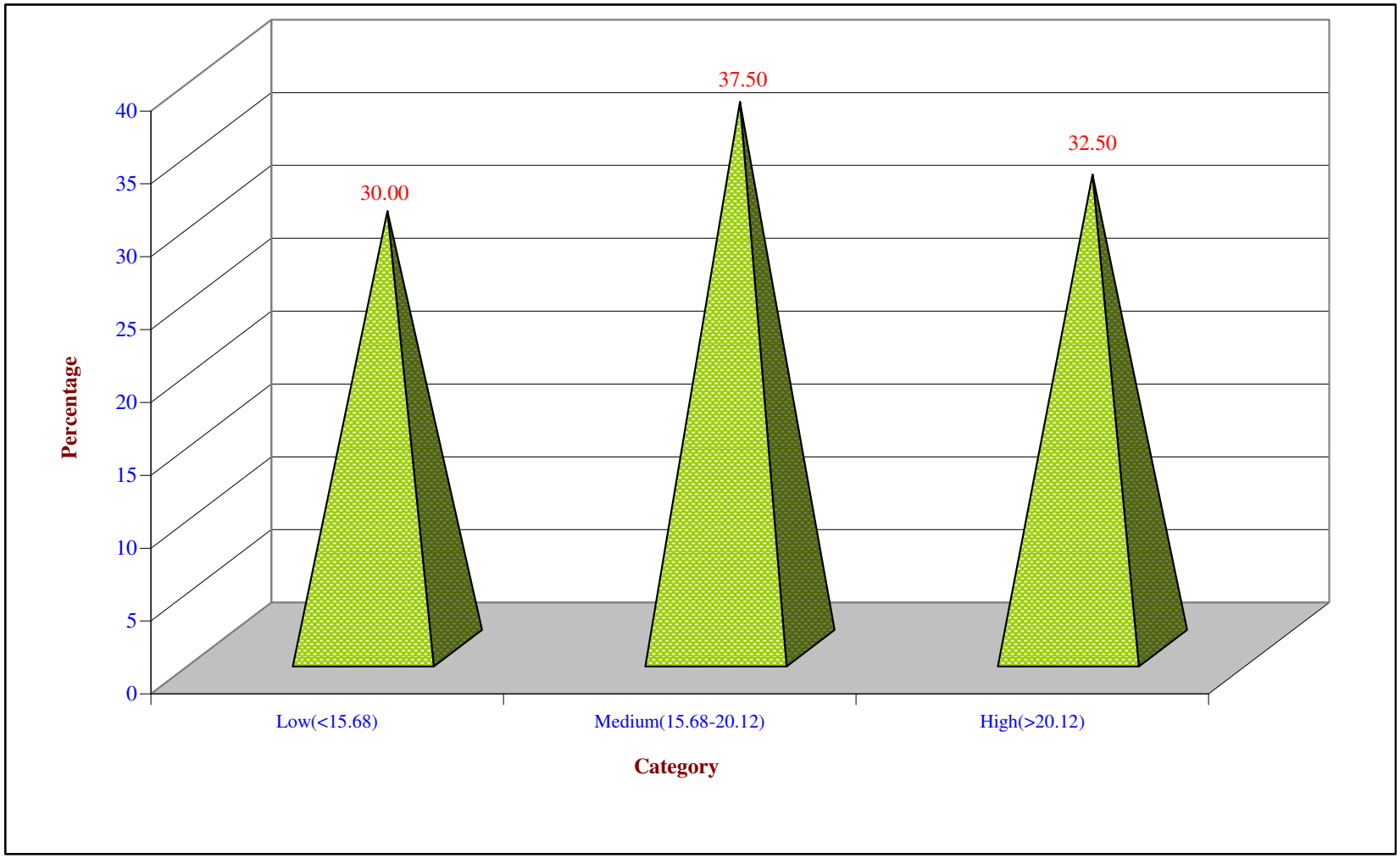


Fig. 7: Distribution of the respondents according to their economic motivation

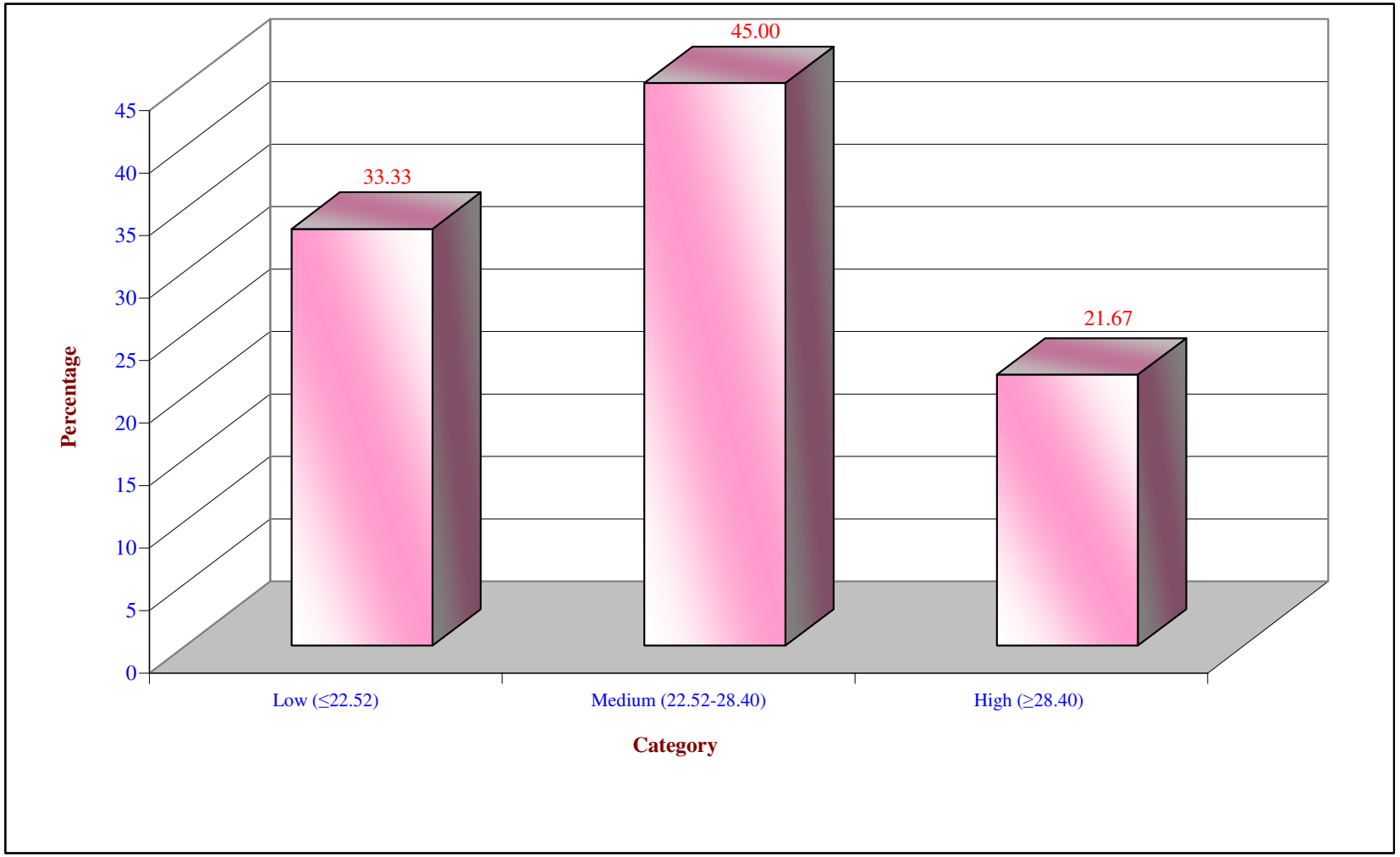


Fig. 8: Distribution of respondents based on the overall knowledge level of the post harvest management practices in mango

4.2.2.2 Pre and post harvest treatment

The advantage of washing of fruits was known to 52.50 per cent, followed by 48.33 per cent possessed knowledge of major cause of post harvest losses. While 35.00 and 29.17 per cent of the respondents had knowledge about the technique to reduce latex exudation and method to remove field heat. Method of avoiding sap burning during harvesting and purpose of waxing, the fruit was known to 20.83 and 15.83 per cent of respondents, respectively. Lastly, knowledge of avoiding fruit fly infection by vapour heat treatment was known to only 4.17 per cent of respondents.

4.2.2.3 Grading and sorting

As equal percentage of respondents (72.50%) had knowledge about importance of grading and practicing of grading and sorting.

4.2.2.4 Storage of fruits

Majority of the respondents had knowledge about storage types causing major loss (91.67%) and keeping mango fruits in plastic tray as the best method of storage (90.00%). The knowledge of optimum temperature for storage of mango fruits was noticed with 30.83 per cent of respondents. But a very less percentage of farmers (10.83%) were knowing the fact that chilling injury leads to reduction in fruit quality and method for increasing shelf life of fruits.

4.2.2.5 Packing

The data depicted in Table 11, revealed that comparatively more number of respondents (72.50%) had knowledge about importance of packing. The knowledge of best fruit packing material, ripened fruits not suitable for packing to distant markets and use of ideal cushion material for packing was noticed among 67.50, 65.00 and 56.67 per cent, respectively. Whereas, knowledge about positioning fruit in packing and chemical used while packing of fruits was noticed with 16.67 and 5.83 per cent of respondents, respectively.

4.2.2.6 Fruit ripening

It was observed that cent per cent respondents had knowledge about name of harmful gas for artificial ripening whereas knowledge about the ideal temperature for ripening of the fruits (25.83%) was noticed with 25.83 per cent. But, negligible percentage (4.17%) possessed knowledge about ideal temperature and relative humidity for degreening of fruits and chemical used for degreening of fruits.

4.2.2.7 Transportation

Transportation of fruits by train as the best method of transportation for distant places was known to 64.17 per cent respondents while, 46.67 per cent of respondents had knowledge about method to minimize losses during transportation. But, knowledge of essentiality of pre-cooling in transportation system was observed with 13.33 per cent of respondents only.

4.2.2.8 Processing

All the respondents had knowledge about processed products of mango and stage of fruit suitable for preparation of pickles. Varieties best suited for processing was known to 90.00 per cent respondents, followed by 73.33 per cent possessed knowledge about stage of fruit suitable for preparation of processed products.

4.2.2.9 Control of pests and diseases in storage

Majority of mango growers (84.17%) had knowledge of susceptible variety (Alphanso) to spongy tissue. The symptoms of spongy tissue and knowledge about convectional heat leads to spongy tissue was known to 23.33 and 21.67 per cent respondents, respectively.

Table 10: Distribution of respondents based on knowledge level of individual post harvest management practices

(n = 120)

Sl. No	Details of the post harvest management practices	No.	Per cent
I.	Harvesting practices		
1	Duration taken for maturity of fruits	112	93.33
2	Chemical used to reduce post harvest losses	28	23.33
3	Use of grafted plants to get early yields	120	100.00
4	Method to identify the maturity of fruit	115	95.83
5	Ideal time for harvesting of the fruit	105	87.50
6	Method of harvesting: a using fruit picker	93	77.50
	b. Using picking pole	120	100.00
7	Identifying the maturity of the fruits dipping in salt water	60	50.00
8	Noticing the variation in fruit maturity	36	30.00
II.	Pre and post harvest treatments		
1	Method of avoiding sap burning during harvesting	25	20.83
2	Technique to reduce latex exudation	42	35.00
3	Advantage of washing fruits	63	52.50
4	Avoiding fruit fly infection by vapour heat treatment with ethylene dibromide.	05	4.17
5	Methods to remove the field heat	35	29.17
6	Major cause for the post harvest loss	58	48.33
7	Purpose of waxing the fruits	19	15.83
III	Grading and Sorting		
1	Importance of grading	87	72.50
2	Practice of grading and sorting	87	72.50
IV	Storage		
1	Storage type causinges major loss	110	91.67
2	Keeping mango fruits in plastic tray as the best method of storage	108	90.00
3	Optimum temperature for the storage of the mango fruits	37	30.83
4	Chilling injury leads to reduction in fruit quality and increase spoilage	13	10.83
5	Method for increasing shelf life of fruits	13	10.83

Contd…..

Sl. No	Details of the post harvest management practices	No.	Per cent
V	Packing		
1	Important of proper packing is while transporting the fruits to distance market.	87	72.50
2	Ripened fruits are not suitable to packing for distant market.	78	65.00
3	Packing material best suited	81	67.50
4	Ideal cushioning material for packing	68	56.67
5	Chemical used while packing of the fruits	07	5.83
6	Position in which the fruits have to be packed	20	16.67
VI	Fruit ripening		
1	Ideal temperature for ripening of fruit	31	25.83
2	Ideal temperature for degreening of the fruits	05	4.17
3	Ideal relative humidity for degreening of the fruits	05	4.17
4	Harm full gas for artificial ripening	120	100.00
5	Chemical used for degreening of the fruits	05	4.17
VII	Transportation		
1	Method to minimize losses during transportation	56	46.67
2	Type of transportation system needs for pre-cooling	16	13.33
3	Best method of transportation of fruits for longer distance	77	64.17
VIII	Processing		
1	Variety best suited for processing	108	90.00
2	Processed products of mango	120	100.00
3	Stage of fruit best suited for preparation of pickles	120	100.00
4	Stage of fruit best suited for preparation of jam, jelly, juice, canning	88	73.33
IX	Control of pests and diseases		
1	Chemical used to avoid pathogen infection	19	15.83
2	Symptoms of anthracnose infection	20	16.67
3	Mode of infection of stem end rot disease	25	20.83
4	Diseases which appears after slicing the fruit	24	20.00
5	Characteristics of jelly seed.	14	11.67
6	Countries restricted importing of mango fruits due to infection of fruit fly.	05	4.17
7	Symptoms of spongy tissue	28	23.33
8	Mango variety susceptible to spongy tissue	101	84.17
9	Use of convectional heat leads to spongy tissue	26	21.67

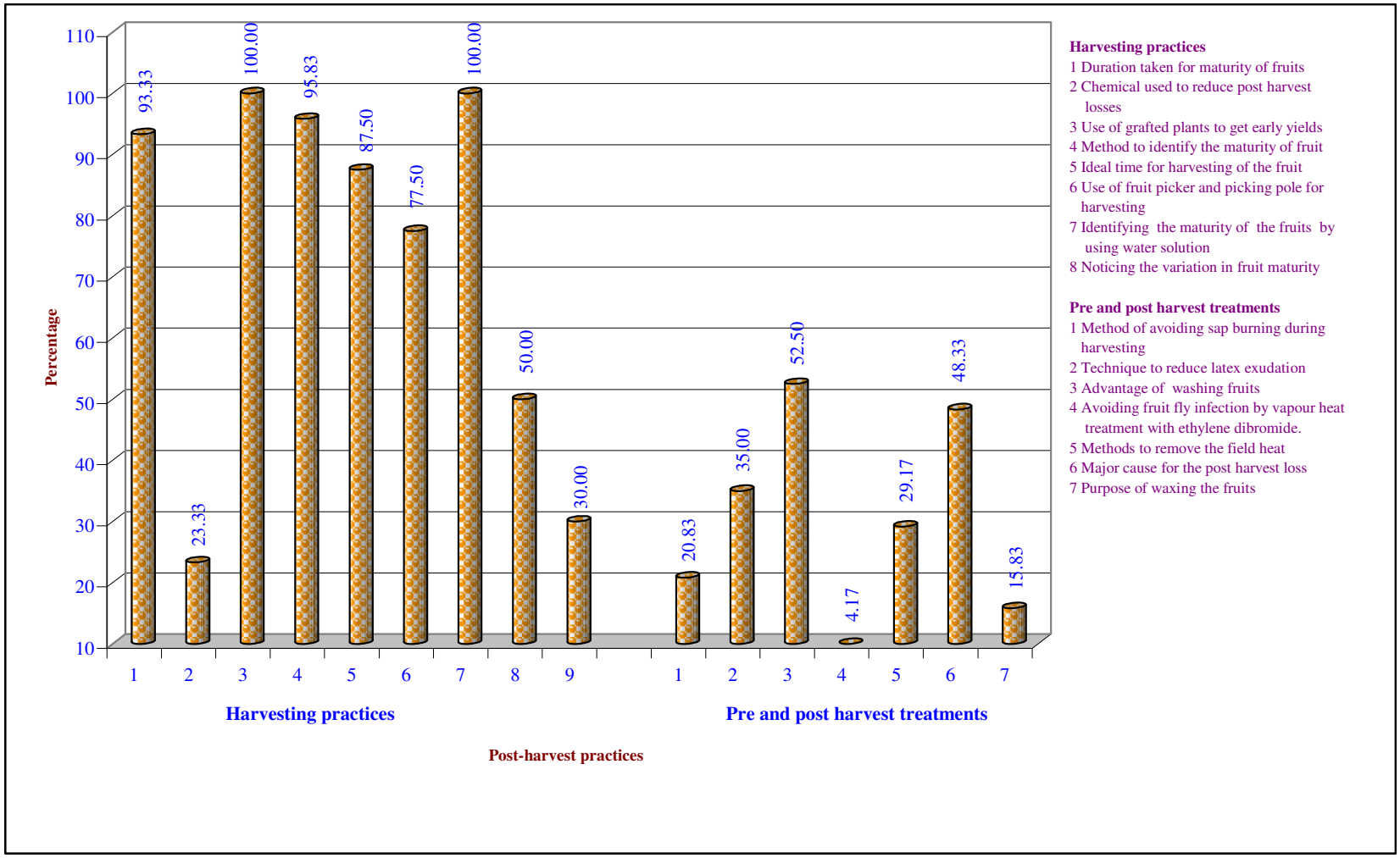


Fig. 9a: Distribution of respondents based on knowledge level of individual post harvest management practices

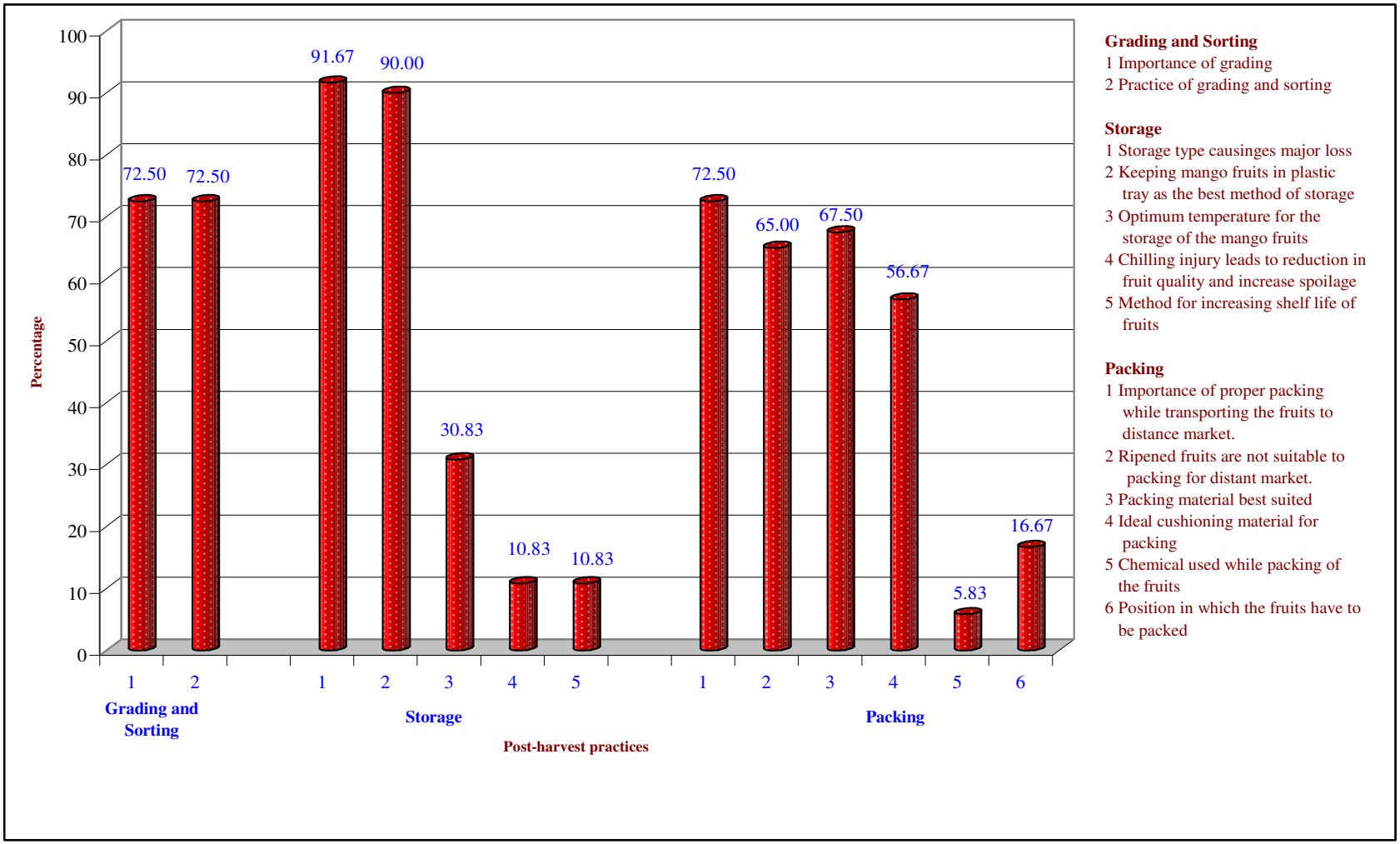


Fig. 9b: Distribution of respondents based on knowledge level of individual post harvest management practices

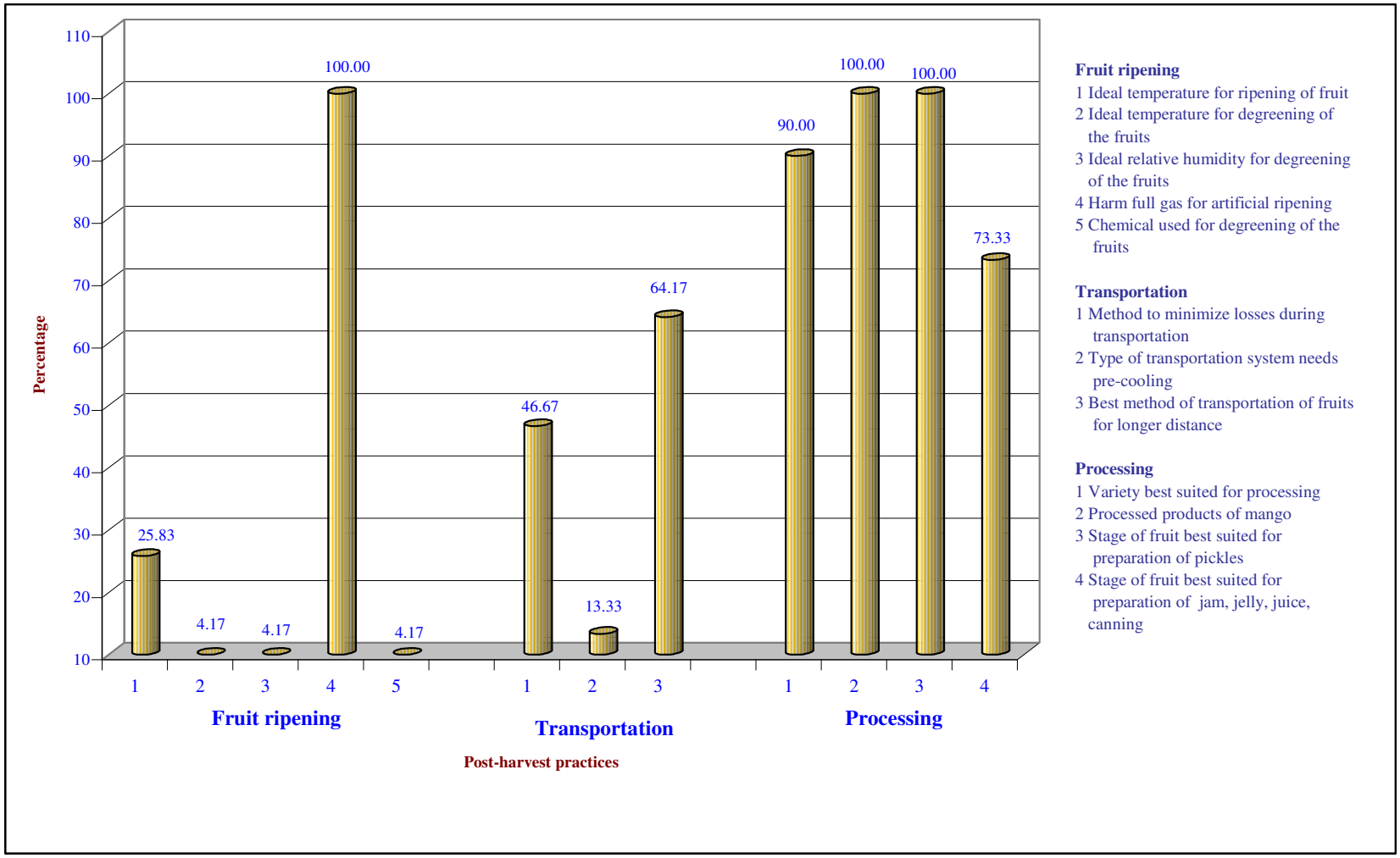


Fig. 10a: Distribution of respondents based on knowledge level of individual post harvest management practices

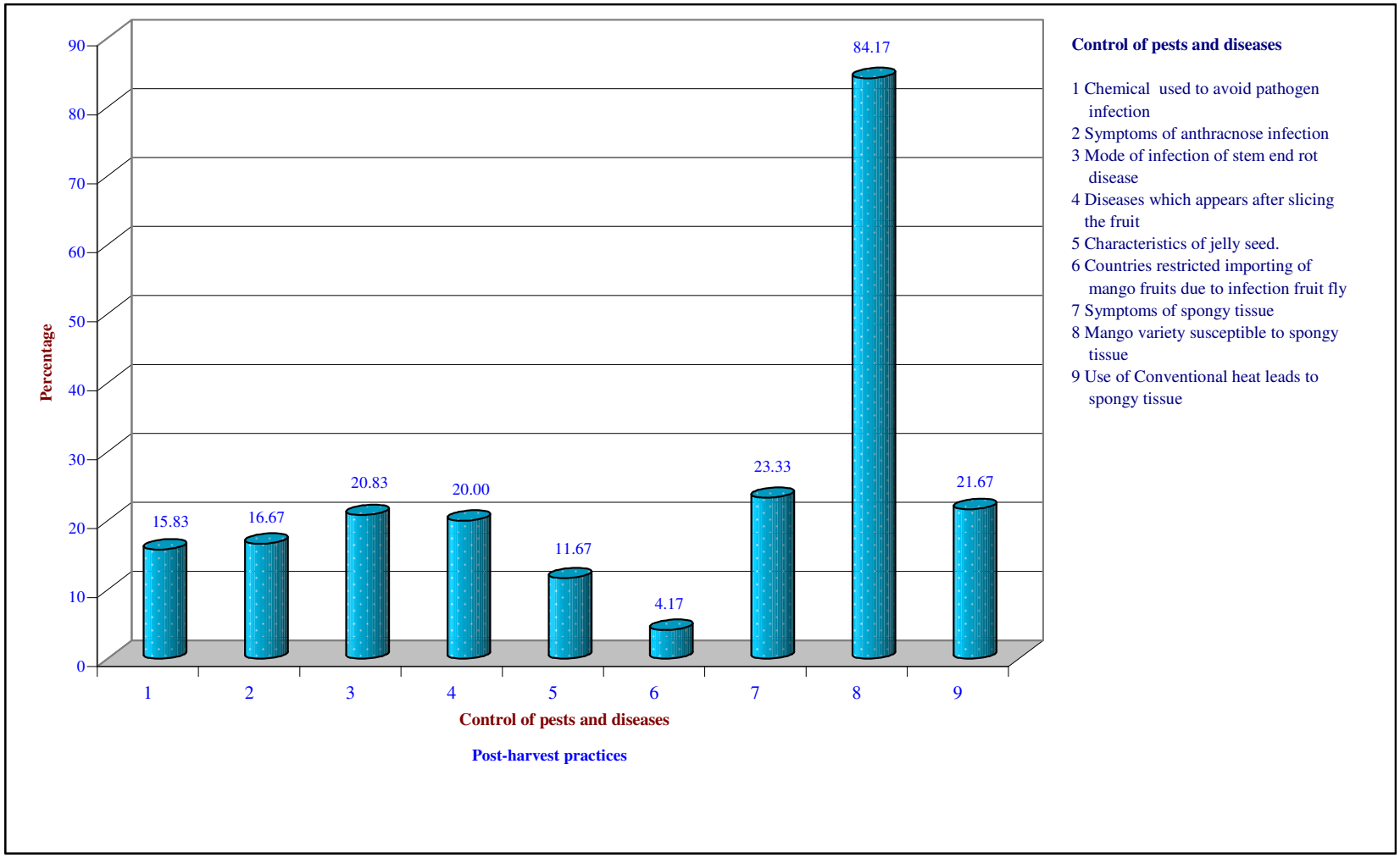


Fig. 10b: Distribution of respondents based on knowledge level of individual post harvest management practices

4.3 Extent of adoption of improved post-harvest management practices

4.3.1 Overall adoption level of farmers about post-harvest management practices

The information in Table 11 depicts the overall adoption of post- harvest management practices amongst respondents. The results indicated that comparatively more number (45.00%) of respondents belonged to low adoption category, followed by medium adoption with 40.83 per cent. However, high level of adoption was observed with 14.17 per cent respondents only.

4.3.2 Extent of adoption of individual recommended post-harvest management practices

4.3.2.1 Maturity and harvesting practices

The results presented in Table 12 and Fig. 10a revealed that the majority of the respondents (95.00%) fully adopted recommended variety (Alphanso and Mallika), followed by ideal method of harvesting (71.67%). Recommended time of harvesting was adopted by 52.50 per cent respondents. Lastly, the practice of judging maturity of fruit based on specific gravity was noticed with 31.67 per cent of respondents.

4.3.2.2 Pre and post-harvest treatments

Majority of respondents did not adopt all the recommended pre and post-harvest treatments like washing of the fruits in hot water after harvest (84.17%), measures for controlling sap burning (80.00%) and pre-harvest sprays (76.87%).

4.3.2.3 Grading and sorting

It was observed that more than fifty per cent of respondents did not adopt the grading and sorting of the fruits based on size, weight, colour (55.00%) and method of grading of fruits either manually or for scientific grading (51.67%).

4.3.2.4 Storage

The practice of storing fruits in plastic crates was fully adopted by only 15.00 per cent of respondents followed by storing fruits in closed and fully ventilated room by 7.50 per cent of respondents only.

4.3.2.5 Packing

None of the respondents used potassium permanganate while packing of fruits. However, use of wooden crates/CFB boxes for packing was noticed with 13.33 per cent and paper shreds as cushioning material with only 5.83 per cent of respondents.

4.3.2.6 Ripening

It was observed that majority of respondents (68.33%) did not use chemicals for artificial ripening (ethylene)

4.3.2.7 Transportation

Majority (81.67%) of the respondents did not follow transportation of fruits for distant places by train.

4.3.2.8 Control of storage pests and diseases

The chemical method of control was fully adopted by only 11.67 per cent of respondents. But, the adoption of recommended chemical concentration and time of application was noticed with 7.50 and 9.17 per cent, respectively.

Table 11: Distribution of respondents based on their overall adoption of the post harvest management practices in mango

(n = 120)

Sl. No.	Category	No.	Per cent
1	Low (≤16.51)	54	45.00
2	Medium (16.51-21.26)	49	40.83
3	High (≥21.26)	17	14.17
	Mean	18.89	
	SD	5.59	

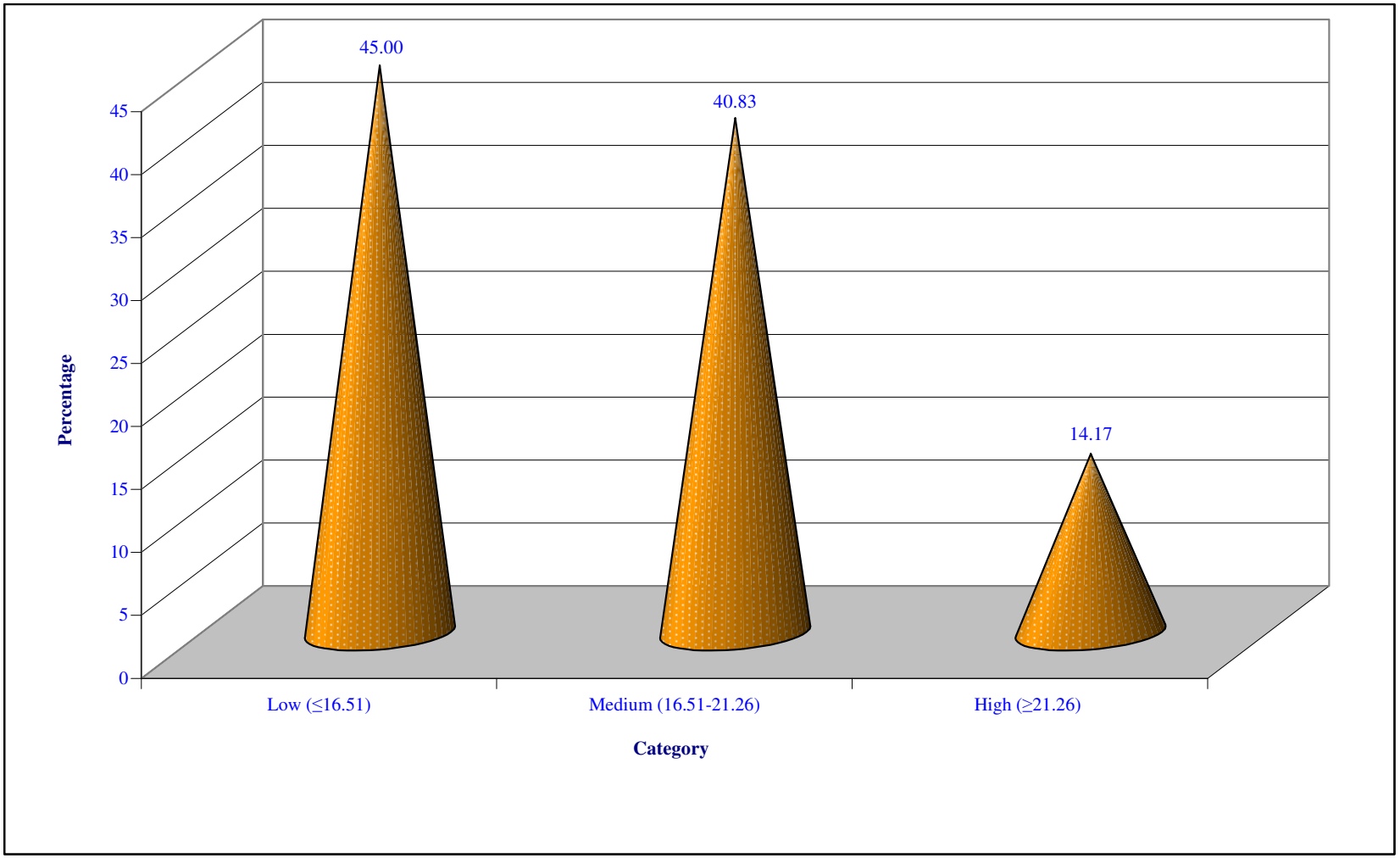


Fig. 11: Distribution of respondents based on their overall adoption of the post harvest management practices in mango

Table 12: Distribution of respondents according to adoption of post harvest management practices in mango

(n = 120)

Sl. No.	Practices	Level of adoption					
		Fully adopted		Partially adopted		Not adopted	
		No.	%	No.	%	No.	%
I	Maturity and harvesting						
1	Variety	114	95.00	06	5.00	0	0.00
2	Judging maturity	38	31.67	67	55.83	15	12.50
3	Stage of fruit at harvest	27	22.50	50	41.67	43	35.83
4	Method of harvesting	86	71.67	33	27.50	0	0.00
5	Time of harvesting	63	52.50	43	35.83	14	11.67
II	Pre and post harvest treatments						
1	Measures for controlling sap burning	6	5.00	18	15.00	96	80.00
2	Pre harvest sprays	18	15.00	10	8.33	92	76.67
3	Washing of the fruits after harvest Hot water treatment	0	0.00	19	15.83	101	84.17
III	Grading and sorting						
1	Grading and sorting of the fruits based on size/ weight/ colour	40	33.33	14	11.67	66	55.00
2	Method of grading of the fruits Manual grading/ Scientific grading	40	33.33	18	15.00	62	51.67
IV	Storage						
1	Storage of fruits in plastic crates	18	15.00	20	16.67	82	68.33
2	Storage of fruit in closed & fully ventilated room	09	7.50	27	22.50	84	70.00

Contd…..

Sl. No.	Practices	Level of adoption					
		Fully adopted		Partially adopted		Not adopted	
		No.	%	No.	%	No.	%
V	Packing						
1	Use of wooden crates/ CFB boxes for packing	16	13.33	33	27.50	71	59.17
2	Paper shred as cushioning material used for packing	07	5.83	37	30.83	86	71.67
3	Use of potassium permanganate while packing	0	0.00	0	0.00	120	100.00
VI	Ripening						
	Chemical used for artificial ripening	25	20.83	13	10.83	82	68.33
VII	Transportation						
	Transport of the fruits for distant places by train	19	15.83	3	2.50	98	81.67
VIII	Control of storage pest and diseases						
1	Chemical method of control	14	11.67	23	19.17	83	69.17
2	Concentration and doses of chemical	9	7.50	16	13.33	95	79.17
3	Time of application of chemical	11	9.17	29	24.17	80	66.67

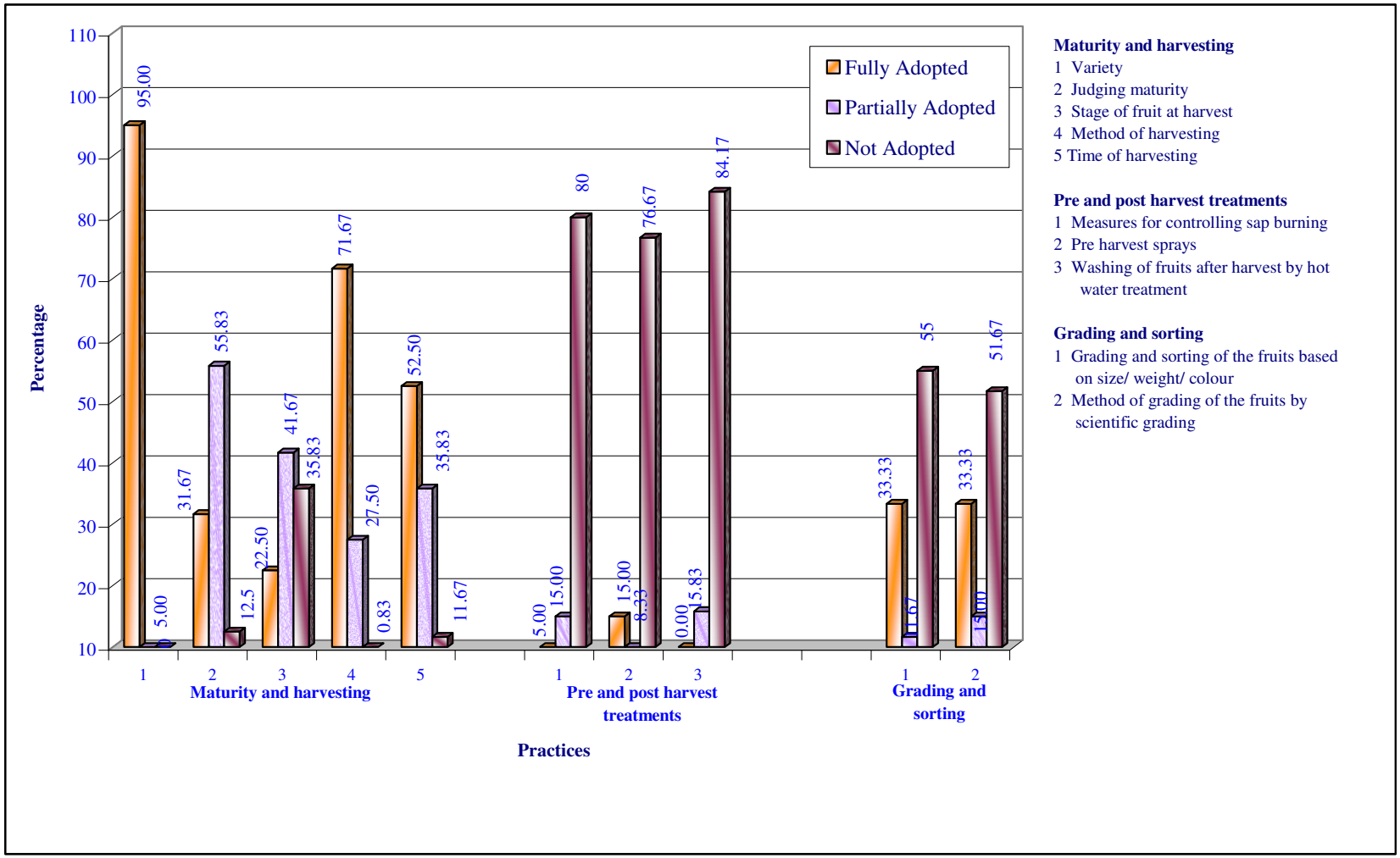


Fig. 12a: Distribution of respondents according to adoption of post harvest management practices in mango

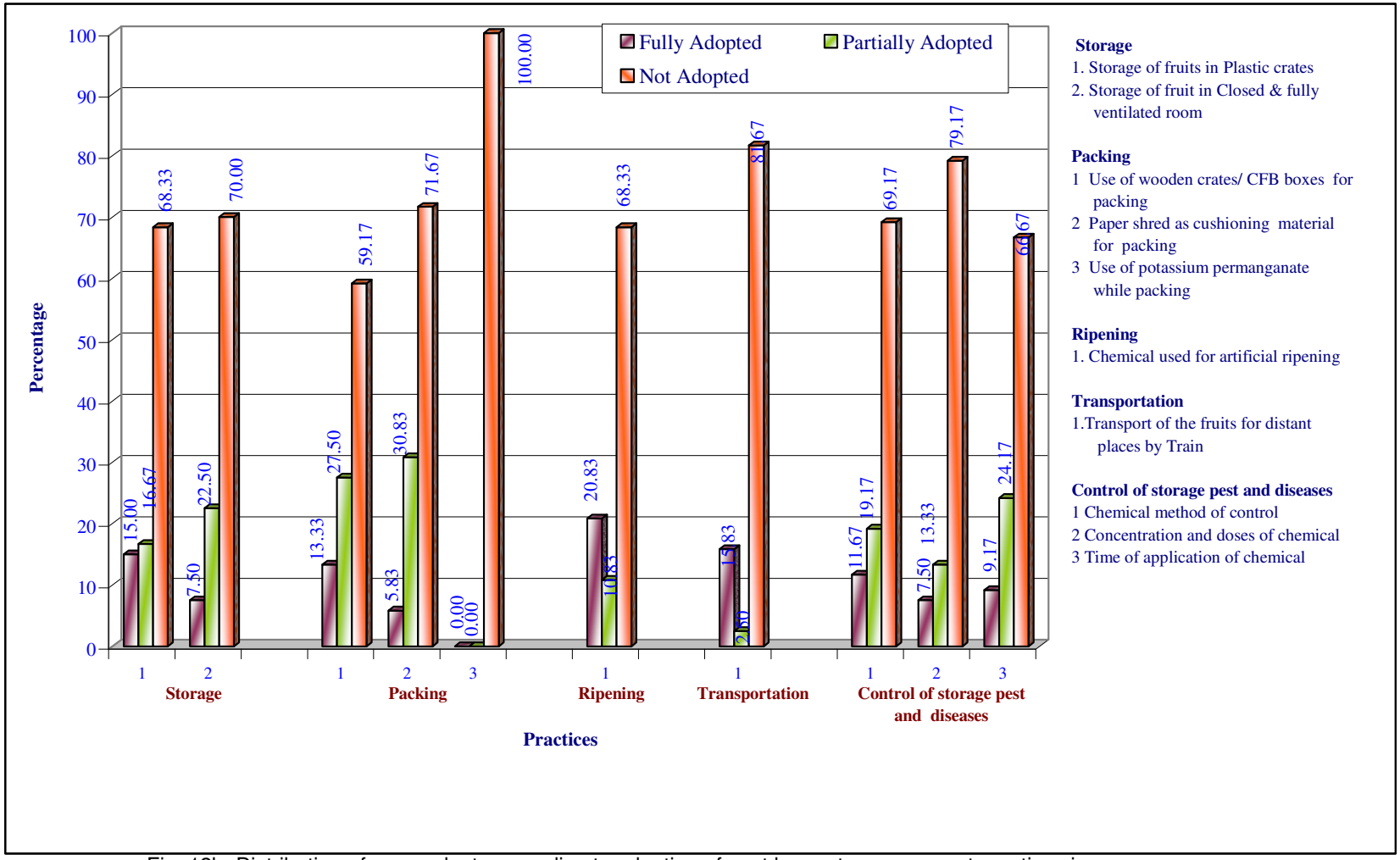


Fig. 12b: Distribution of respondents according to adoption of post harvest management practices in mango

Table 13: Relationship between entrepreneurial characteristics with knowledge level of the respondents

(n = 120)

Sl. No.	Variables	'r' value
1	Risk Orientation	0.256**
2	Achievement motivation	0.465**
3	Economic Motivation	0.705**

** Significant at 1% level of probability

Table 14: Relationship between entrepreneurial characteristics with adoption level of the respondents

(n = 120)

Sl. No	Variables	'r' value
1	Risk Orientation	0.195*
2	Achievement motivation	0.466**
3	Economic Motivation	0.668**

* Significant at 5% level of probability

** Significant at 1% level of probability

Table 15: Constraints faced by mango growers in adoption of improved post harvest management practices

(n = 120)

Sl. No.	Constraints	Per cent of respondents expressing the constraints
1	Labour shortage and high wages	75.00
2	Lack of technical knowledge and guidelines about improved post harvest technologies of mango	71.67
3	Time consuming process in adopting technologies	63.33
4	High fluctuation in market price	62.50
5	Non-availability of sufficient credit	54.17
6	High cost of pesticide and other inputs	53.33
7	Non adaptability of post harvest technologies and equipment	51.66
8	Non availability of input & facilities	48.33
9	Lack of processing units	44.17
10	Lack of irrigation facilities and power shortage	39.17
11	High transportation cost	18.33

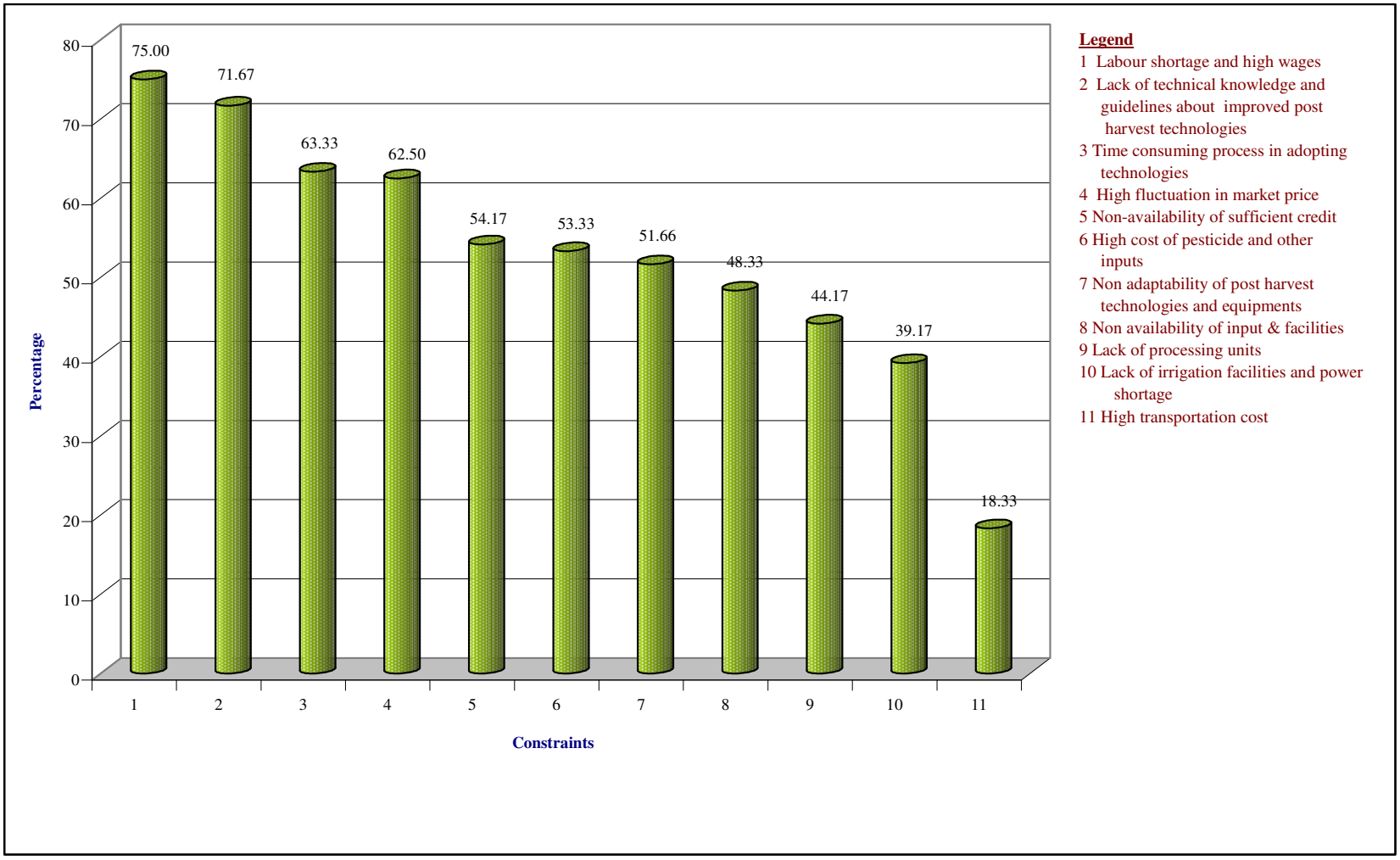


Fig. 13: Constraints faced by mango growers in adoption of improved post harvest management practices

4.4 Relationship between entrepreneurial characteristics of respondents with knowledge and adoption of improved post-harvest management practices

4.4.1 Relationship between entrepreneurial characteristics of respondents with knowledge of improved post-harvest management practices

The results of simple correlation value as depicted in Table 13 shows that all the selected entrepreneurial characteristics such as risk orientation, achievement motivation and economic motivation were found to be highly significantly associated with knowledge of post harvest management practices at one per cent level of probability.

4.4.2 Relationship between entrepreneurial characteristics with adoption of post harvest management practices

It is evident from the results shown in Table 14 that the achievement motivation and economic motivation were found to significantly correlated with adoption level at 1% level of probability, whereas risk orientation was found to be significantly associated with adoption of post harvest management practices at 5 per cent level of probability.

4.5 Constraints faced by mango growers in adoption of improved post harvest management practices

The constraints as expressed by respondents in adoption of post- harvest management practices has been depicted in Table 15. It was observed that, a high per cent of respondents highlighted the constraints of labour shortage and high wages of labour (75.00%), followed by lack of technical knowledge and guidelines about improved post harvest technology of mango (71.67%). About two-third of respondents expressed the constraints of time consuming process (63.33%) in adoption of new technologies and high fluctuation in market price (62.50%). Around fifty per cent of respondents highlighted the constraints of non-availability of sufficient credit (54.17%), high cost of pesticides and other inputs (53.33%) and non-availability of post-harvest technologies and equipments (51.66%).

The moderate percentage of farmers expressed the constraints of non-availability of input and facilities (48.33%), lack of processing units (44.17%), lack of irrigation facilities and power shortage (39.17%). Lastly, the constraint of high transportation cost was highlighted by only 18.33 per cent of respondents.

5. DISCUSSION

The results of the study are discussed in this chapter under the following headings.

5.1 Personal, socio-economic and psychological characteristics of mango growers

5.1.1 Education

The data in the Table 1 revealed that around one-third of respondents (28.33%) were educated upto middle school, followed by high school (21.67%) and primary school (16.67%) education. The education upto PUC (11.67%) and graduates (8.33%) were also noticed. But, 13.33 per cent were noticed to be illiterates. This might be due to relative importance of literacy and increased facilities for education also, the increased cosmopoliteness amongst farmers convinced the belief that getting good education will help to acquire more knowledge and exposure to the happenings.

The findings of the study are in line with the results of Jayale (1992), Angadi (1999) Srinivasa Reddy (1995) and Moulasab (2004).

5.1.2 Land holding

A little more than one-third of the respondents were noticed to be small farmers (34.17%) followed by the category of semi-medium (31.17%) medium farmers (21.67%) and marginal (8.33%) farmers. The continuous fragmentation of land holdings might be the reason for this situation.

The similar situation of land holding distribution was also noticed in the findings of Saravana Kumar (1996), Vijayakumar (1997) and Shashidhar (2003).

5.1.3 Farming experience

Exactly one-third of respondents had medium level of farming experience of 21 to 34 years (33.33%), followed by low (28.33%) and (18.33%) high farming experience, respectively. This shows that the farming sector in the study area has been attracting youth because of the unemployment and profitable horticulture. The results are in accordance with the findings of Chandre Gowda (1993) and Birajdar (2005).

5.1.4 Experience in mango cultivation

Around one-third of the respondents (35.00%) had more than 14 years of experience in mango cultivation, followed by high experience in mango cultivation of more than 18 years (33.33%) and low experience of less than 14 years (31.64%). The increased importance for mango produce, declining labour availability and schemes for promoting mango cultivation might be the reasons for the present situation. The similar results have been reported in the study of Patalia (1991).

5.1.5 Socio-economic and psychological characteristics

5.1.5.1 Mass media utilization

The distribution of respondents in the use of mass media revealed that a little more than one-fourth of the respondents (30.00%) were noticed in medium level of mass media use. And the detailed analysis of mass utilization (Table 2) shows that the majority of respondents were regularly watching agriculture programmes in television (90.83%), followed by newspapers (59.17%), radio (45.00%) and farm magazines (17.50%).

Non-availability of required information in time from the farm magazines, non-subscription of magazines and lack of reading habit might have influenced the situation. Similarly, non-possession of radio and the more inclination towards television programmes and possession of TV sets might be the reasons for this situation.

The results of Dhamodharan and Vasanthkumar (2001), Vedamurthy (2002) and Shashidhara (2003) showed that around fifty per cent of respondents had medium level of mass media utilization.

5.1.5.2 Risk orientation

The medium risk orientation was noticed among fifty per cent of the respondents followed by an equal per cent of respondents were found to possess high (24.17%) and low (25.83%) risk orientation. Lack of technical knowledge on improved post-harvest practices, low economic returns on investment lack of financial support and labour problem might have faced the respondents to take medium level of risk in post-harvest management practices. The results are on par with the findings of Ajaykumar (1989), Anand (1992), Chandrapaul (1998), Vijayakumar (2001) and Vedamurthy (2002).

5.1.5.3 Extension participation

The overall distribution of respondents in extension participation (Table 3) showed that majority of respondents (60.00%) had medium extension participation. Further the detailed analysis of participation in various extension activities revealed that the majority of respondents were found to participate regularly in the Krishimela (67.50%), whereas less participation was noticed in field days (35.00%), field visits (30.83%) and agricultural exhibitions (28.33%). The results are in line with the results of Venkataramulu (2003) among chilli growers.

The increased importance and publicity of Krishimela and opportunities to visit might have favoured for higher participation.

5.1.5.4 Achievement motivation

Majority of respondents (77.00%) belonged to medium level of achievement motivation followed by low (23.00%) and high (20.00%) level of achievement motivation.

Not confident of higher returns and lack of confidence to practice improved management practices might be reasons for the results. The similar results are observed with the studies of Sivanarayana (1990), Raghavendra (1997), Palaniswamy and Sriram (2001) and Nagesh (2006).

5.1.5.5 Economic motivation

Around one-third respondents were noticed in medium (37.50%), high (32.50%) and low (30.00%) economic motivation categories.

The inclination of the respondents to take up average level practices with the available resources might have favoured the situation. The present data gets the support of the results of the study conducted by Nagesh (2006) on pomegranate growers and Atul (2008) on grape growers. The results are on par with the findings of Srinivas Reddy (1995). Whereas, studies of Saravanakumar (1996), Sawant (1999), Nagesh (2006) and Atul (2008) reported the more distribution of respondents in medium category of economic motivation.

5.2 Extent of knowledge possessed by respondents about post-harvest management practices in mango

5.2.1 Distribution of respondents in the overall knowledge about post-harvest management practices in mango

It is clear from Table 7 that, the medium level of knowledge was noticed with 45.00 per cent of respondents, whereas, high knowledge level was noticed among only 21.67 per cent of respondents.

This shows that respondents might not have been exposed the training opportunities and other extension educational activities.

The findings were in conformity with the results of Mehta *et al.* (2000), Jayale (1992) and Saravankumar (1996), who also reported that majority of the respondents had medium level of knowledge.

5.2.2 Knowledge of individual post-harvest management practices

The results on existence of knowledge about individual post-harvest management practices as depicted in Table 8 are discussed under the following headings.

5.2.2.1 Harvesting practices

It was observed that cent per cent of mango growers had knowledge about use of grafted plants and use of picking pole for harvesting.

Majority of them (95.83%) had knowledge about identifying the maturity of fruits, duration taken for maturity (93.33%) and ideal time of harvesting (87.50%). This might be due to the realization of importance besides being the routine practices.

It is also noticed that, fifty per cent of sample farmers possessed the knowledge about identifying the maturity of fruits by using water. Whereas, knowledge about noticing variation in maturity of fruits and use of chemical to reduce post-harvest losses was noticed with 30.00 and 23.30 per cent of respondents, respectively. The possible reasons could be lack of knowledge and technical guidance about these practices. The similar results were noticed in the studies of Waman and Patil (1998) and Achuta Raju and Radhakrishnamurthy (2002), whereas the study of Ahire *et al.* (1999) and Moulasab (2004) were found to contradict the present results.

5.2.2.2 Pre and post-harvest treatment

More than fifty per cent of mango growers (52.50%) found to possessed knowledge of washing mango fruits, followed by knowledge about causes of post-harvest loss (48.33%). While, 35.00 and 29.17 per cent of the respondents had knowledge about the technique to reduce the latex exudation and method to remove field heat.

Whereas, the knowledge about avoiding sap burning during harvesting (20.83%) and purpose of waxing the fruits (15.83%) was noticed with less than one-fifth of respondents. And very least percentage (4.17%) had the knowledge of vapour heat treatment to control fruit fly. The possible reasons could be lack of knowledge and exposure to these technologies. Whereas, the research study of Chand and Sharma (1993) noticed higher distribution of respondents in the knowledge level o pre and post-harvest treatments.

5.2.2.3 Grading and sorting

Majority of the mango growers (72.50%) possessed knowledge of importance of grading and practicing of grading and sorting. The studies of Bhople *et al.* (1996), Achuta Raju and Radhakrishnamurthy (2002) and Sunil Kumar (2004) confirmed that majority of respondents had knowledge about grading. Whereas, results of study conducted by Ahire *et al.* (1999) found to contradict the present results.

5.2.2.4 Storage of fruits

It was observed that a high per cent of respondents had knowledge about types of storage losses (91.67%) and keeping mango fruits in plastic trays as the best method of storage (90.00%). Whereas, practice of maintaining optimum temperature for storage of mango fruits was known to less than one-third of respondents and very least percentage (10.83%) were knowing that chilling injury leads to reduction in fruit quality and method for increasing shelf life of fruits. The findings are in accordance with the studies of Moulasab (2004) and Sunil Kumar (2004), but the results of Waman and Patil (1998) reported the less distribution of respondents.

5.2.2.5 Packing

The importance of packing was known to majority of respondents (72.50%). Similarly, moderate percentage of respondents had the knowledge of best fruit packing material (67.00%), non-suitability of ripened fruits for packing to distant markets (65.00%) and use of ideal cushion material for packing (56.67%). The realized importance of these practices and contact with marketing sources might have favoured the situation. But, the knowledge about positioning fruit in packing (16.67%) and chemical used while packing of fruits (5.83%) were the least known practices. This might be due to non-availability of packing materials and high cost incurred.

The findings reported by Achuta Raju and Radhakrishnamurthy (2002) and Moulasab (2004) observed that all the respondents had knowledge of packing. Whereas, the study results of Ahire *et al.* (1999) was found to be not supporting the present findings.

5.2.2.6 Fruit ripening

All the respondents were knowing the name of harmful gas used for artificial ripening. Whereas, one-fourth of them possessed knowledge about the ideal temperature for ripening of fruits (25.83%), Also, negligible percentage (4.17%) had knowledge about requirement of ideal temperature and relative humidity and chemical for degreening of fruits.

5.2.2.7 Transportation

Majority of the farmers (64.17%) knew that transportation of fruits by train as the best method of transportation, whereas, less than fifty per cent (46.66%) respondents had the knowledge of methods to minimize losses during transportation. But, very less percentage of respondents (13.33%) possessed the knowledge of pre-cooling in transportation system. This shows that the transportation of fruits to longer distance might not be preferred in the study area.

5.2.2.8 Processing

The types of processed products and stage of fruit suitable for preparation of pickles was known to all the respondents. Similarly, the knowledge about varieties best suited for processing was known to 90.00 per cent respondents followed knowledge of stage of fruit suitable for preparation of processed products (73.33%). Whereas, the studies conducted by Mehta *et al.* (2000), Moulasab (2004) and Sunil Kumar (2004) reported that around fifty per cent of respondents had knowledge of processing.

5.2.2.9 Control of storage pests and diseases in storage

Majority of respondents (84.17%) had knowledge of varieties susceptible to spongy tissue. This might be their long experience in cultivating alphanso variety in study area. But, a very less percentage were knowing of chemical to avoid pathogen infection (15.83%) and symptoms of anthracnose infection (16.67%). But, the research results of the Waman and Patil (1998) noticed that less than fifty per cent of respondents had knowledge of storage pests and disease control.

5.3 Extent of adoption of improved post-harvest management practices

5.3.1 Overall adoption level of farmers about post-harvest management practices

The distribution of respondents in the overall adoption of post-harvest management practices (Table 9) revealed that comparatively more number of respondents (45.00%) belonged to low adoption category followed by medium adoption (40.83%). But, a less number of respondents (14.17%) was noticed in high level of adoption.

5.3.2 Extent of adoption of individual recommended post-harvest management practices

5.3.2.1 Maturity and harvesting practices

It was noticed that a high per cent of respondents (95.00%) were found to adopt recommended varieties (Alphanso and Mallika) followed by ideal method of harvesting (71.67%). The recommended time of harvesting was observed amongst fifty per cent of respondents (52.50%). But, the practice of judging maturity and stage of fruit to be harvested was noticed among 31.67 and 22.50 per cent of respondents, respectively.

The more suitability and lucrative price might have forced for larger area of cultivation. These findings are in accordance with the findings of Venugopal Reddy (1993), Deshmukh *et al.* (1998), Palande *et al.* (2001) and Sunil Kumar (2004).

5.3.2.2 Pre and post-harvest treatment

It was observed that majority of respondents did not adopt pre and post-harvest treatments like washing of the fruits in hot water (84.17%), practices for controlling sap burning (80.00%) and pre-harvest sprays (76.87%). The more labour requirement, lack of

knowledge and technical guidance about the importance and procedure of pre and post-harvest treatments might be the reason for the situation.

5.3.2.3 Grading and sorting

More than fifty per cent of the respondents did not adopt grading and sorting of the fruits based on size, weight and colour (55.00%), and methods of grading (51.67%). This might be due to time constraint, lack of knowledge and difficulty in getting labour. Similar findings were also reported by Sunil Kumar (2004), but contradictory findings were reported by Moulasab (2004).

5.3.2.4 Storage

The practice of storing fruits in plastic crates and in a closed and fully ventilated rooms was noticed with only 15.00 and 7.50 per cent of respondents, respectively. This might be due to immediate disposal of fruits coupled with high cost involved and difficulty in getting timely labour. These findings are in accordance with the results of Reddy and Patnakar (1992) and Venugopal Reddy (1993), whereas high per cent of adoption was noticed in the studies of Waman and Patil (1998), Kubde *et al.* (2000) and Selvarajan and Manoharan (2004).

5.3.2.5 Packing

None of the respondents were using potassium permanganate while packing fruits. Similarly, high per cent (71.67%) were not using paper shreds as cushioning material. However, use of wooden crates/CFC boxes for packing was observed with 13.33 per cent of respondents. This might due to not aware of proper packing methods and their advantages. These results are in accordance with the Reddy and Patnakar (1992) and Moulasab (2004).

5.3.2.6 Ripening

Majority of respondents (68.33%) did not used chemicals (ethylene) for artificial ripening. The non-availability of chemical in the local market and lack of knowledge about use of chemicals for artificial ripening might be the reasons for the situation.

5.3.2.7 Transportation

It was observed that majority of the respondents (81.67%) did not followed the method of transporting fruits for distant places by train. The absence of collective efforts in marketing and lack of knowledge of profitable marketing could be the possible reason.

5.3.2.8 Control of storage pests and diseases

The chemical method of control was fully adopted by only 11.67 per cent of respondents. But, the adoption of recommended chemical concentration and time of application was noticed with 7.50 and 9.17 per cent, respectively.

5.4 Relationship between entrepreneurial characteristics of respondents with knowledge level and adoption of improved post-harvest management practices

5.4.1 Relationship between entrepreneurial characteristics of respondents with knowledge of improved post-harvest management practices

The results of simple correlation shows that all the selected entrepreneurial characteristics such as risk orientation, achievement, motivation and economic motivation were found to be highly significantly associated with knowledge of post-harvest management practices at one per cent level of probability. It is obvious that the risk bearing nature, coupled with motivation to achieve more and reap higher profit will naturally forced the respondents to know more of the profitable practices to maximize profit. The results of the study conducted by Venugopal Reddy and Ratnakar (1993), Sundar Shamra (1993), Pandya and Venkaria (1994), Raghavendra (1997), Birajdar (1999) and Thippeswamy (2007) were also in agreement with the present study. But, the findings of Srinivasareddy (1996), Saravanakumar (1996) and Vedamurthy (2002) noticed non-significant relationship with the present findings.

5.4.2 Relationship between entrepreneurial characteristics with adoption of post-harvest management practices

The Table 12 on relationship shows the positive and highly significant relationship of entrepreneurial characteristics like achievement motivation and economic motivation with adoption at one per cent level of probability. Similarly, risk orientation was found to be significantly associated with adoption of post-harvest management at five per cent level of probability. These results are in conformity with the results of Ramesh Babu (1987), Ajay Kumar (1989), Lianbika and Nikhade (1993), Singha (1995), Ajaya Kumar (1999) and Gotyal (2007). Whereas, non-significant relationship reported in the studies of Kantharaju (1989), Kumbar (1983), Kumar (1998) do not support the results of present study. It is the risk bearing capacity which had a greater impact in acceptance of profitable practices besides motivation to achieve more and economic mind setup also had added influence for adopting the recommended profitable practices.

5.5 Constraints faced by mango growers in adoption of improved post-harvest management practices

The delineation of constraints as expressed by respondents in adoption of improved post-harvest practices (Table 13) shows that a high per cent of respondents expressed the problem of labour shortage and high wages of labour (75.00%), followed by lack of technical knowledge and guidelines about improved post-harvest technology in mango (71.67%). This might be the reason for the incidence of low knowledge level and adoption of the improved post-harvest management practices. Similarly, two-third of respondents expressed the constraints of time consuming process in adoption of recommended post-harvest practices (63.33%) and high fluctuation in market price (62.50%). This highlights the natural tendency amongst farmers to produce more and get better price for their produce. These results are in agreement with the findings of Abdul and Kaul (1988), Ajay Kumar (1989), Shaikh *et al.* (1993), Saravanakumar (1996), Vijayakumar (1997), Kumar (1998) and Sunil Kumar (2004).

Around fifty per cent of respondents expressed the constraints of non-availability of sufficient credit (54.17%), high cost of pesticides and other inputs (53.33%) and non-adaptability of post-harvest technologies and equipments (51.66%). The lack of awareness about schemes implemented for the promotion of mango cultivation and lack of contact with extension Officers of Horticulture Development Department might have favoured this adverse situation. Similar constraints were noticed in the studies of Srinivasareddy (1995) and Sharma (1997).

The moderate percentage of farmers expressed the problem of non-availability of input and facilities (48.33%), lack of processing units (44.17%), lack of irrigation facilities and power shortage (39.17%). The usual procedure of getting the inputs from commission agents and inputs dealers with the condition of selling their produce through them only were the compelling situations for the situation. The similar constraints were also noticed in the findings of Sunil Kumar (2004) and Nagesh (2006).

6. SUMMARY AND POLICY IMPLICATIONS

Mango is eulogized as the king of fruits. India produces 13.70 million tonnes of mangoes from an area of 2.20 million hectares has the share of 38.00 per cent area and 21.70 per cent production of major fruits. Andhra Pradesh is the leading state in mango cultivation accounting for 17.98 per cent of the country's total mango area. Karnataka ranks seventh in area (32 m. ha) and third in production (1.33 m. tonnes). In Karnataka, Kolar and Bangalore rural are the largest mango growing districts, similarly in Northern Karnataka, Dharwad and Belgaum are the largest growing districts with an area of 4569.36 and 3964.27 ha produces 55612 and 50673 tonnes, respectively.

Post-harvest management is inter-disciplinary "Science and Technology" applied to mango after harvest for its protection, conservation, processing, packaging, marketing and utilization to meet the food and nutritional requirements of the people in relation to their needs. Number of post-harvest management practices in mango are recommended to get maximum benefit, yet the mango growers are not following the recommended management practices thus, the post-harvest management practices vary from farmer to farmer according to their personal and socio-economic characteristics, perceived training needs, availability of factors of technology and the problems in post-harvest management practices. Hence, an appropriate understanding of the level of knowledge and extent of adoption of recommended post-harvest management practices and constraints analysis would helps to arrive at appropriate extraction and research strategies to increase the rate of adoption.

Keeping this in view, the present investigation was designed with the following specific objectives.

1. To study the entrepreneurial characteristics of established mango growers.
2. To measure the extent of knowledge processed by the mango growers about post-harvest management practices.
3. To measure the extent of adoption of improved post-harvest management practices in mango.
4. To determine the relationship of entrepreneurial characteristics with knowledge and adoption of post-harvest harvest management practices, and
5. To analayse the constraints faced by mango growers in adoption of improved post-harvest management practices.

The study was conducted in Dharwad and Belgaum districts of Karnataka during the year 2008-09. These two districts were selected purposively, as these districts have larger area under mango cultivation. Further, Kalaghatagi and Dharwad taluk from Dharwad district and Belgaum and Khanapur from Belgaum districts were selected in proportion to the highest area under mango cultivation. Thereafter, three villages having the highest area under mango cultivation and also having maximum number of mango growers, were selected from each taluk. One hundred and twenty respondents were selected from the selected 12 villages by adopting simple random sampling.

In the light of the objectives set for the study, knowledge and extent of adoption of mango growers about recommended post-harvest management practices were the two dependent variables. The variables education, land holding, farming experience, experience in mango cultivation, mass media use, risk orientation, extension participation, achievement motivation and economic motivation were the independent variables selected for the study. For determining the knowledge level of post-harvest management practices, the 'teacher made knowledge test' was developed.

The pre-tested interview schedule was used to collect the data from the mango growers by personal interview method. The data collected were scored, tabulated and analysed by using frequency, percentage, mean, standard deviation and correlation.

The salient findings of the parent study area;

Entrepreneurial characteristics of mango growers

1. Nearly one-third of respondents had education upto middle school (5 – 7th), while 13.33 per cent of the sample farmers were illiterates.
2. Around one-third of growers (34.75%) had small land holding, and semi-medium land holding (31.67%).
3. One-third of respondents (33.33%) had medium level of farming experience of 21 to 34 years.
4. An equal per cent of the growers (>30.00%) belonged to low, medium and high experience in mango cultivation.
5. Radio was possessed by 45.00 per cent of the growers while 90.83 per cent possessed television.
6. More than fifty per cent of farmers were found to read agricultural news in publication (53.33%).
7. Around thirty five per cent of the growers were regularly watching agricultural programmes in TV (36.69%), followed by listening of agricultural programmes in radio (34.17%).
8. More number of respondents were found to participate regularly in Krishimela (67.50%), followed by field day (35%) and field visits (30.83%).
9. Fifty per cent of the respondents belonged to medium level of risk orientation.
10. Majority of the respondents (64.16%) were noticed in medium achievement category.
11. Around one-third respondents were noticed in medium and high category of economic motivation.

Knowledge of post-harvest management practices in mango

1. Less than fifty per cent of the respondents possessed medium level of knowledge about post-harvest management practices.
2. All the respondents possessed knowledge about grafted plants, use of picking pole for harvest and use for artificial ripening.
3. A high per cent of respondents had knowledge of duration taken for fruit maturity (95.83%) and identifying maturity of fruit (93.33%).
4. Majority of the respondents had knowledge of storage (91.67%), varieties suited for processing (90.00%), ideal time for harvesting (87.50%), use of fruit pickers for harvest (77.50%), grading importance (72.50%) and importance of packing (72.50%).
5. Moderately more number of respondents possessed knowledge of fruit packing (67.50%), transportation method (64.17%), washing of fruits (52.50%) and causes of post-harvest losses (48.33%).
6. Around one-third of the respondents possessed knowledge of technique to reduce latex exudation (35.00%) noticing variation in fruit maturity (30.00%), chemical to reduce post-harvest losses (25.30%).
7. A very less percentage had knowledge of symptoms of spongy tissue (23.33%) avoiding sap burning during harvest (20.83%), purpose of waxing (15.83%) and necessity of pre-cooling in transportation (13.33%),.

Adoption of post-harvest management practices

1. A high percentage (95.00%) of respondents was found to adopt recommended variety.
2. Majority of the respondents were found to practice recommended method of harvesting (71.62%), followed by time of harvesting (52.57%).

3. One-third of the respondents (33.33%) adopted recommended method of grading and sorting of fruits.
4. Around one-third of the growers were found to judge the correct stage of maturity of fruit (31.67%).
5. Around one-fourth of growers were found to harvest at right stage of fruit (22.50%).
6. Very less percentage of respondents were found to practice recommended storage (15.00%), wooden crates for packing (13.33%) and control of storage pests and diseases (11.67%)
7. Cent per cent of the respondents did not use potassium permanganate while packing.
8. A high percentage of growers did not practice washing of fruits (84.17%), appropriate transportation (81.67%), control of sap burning (80.00%), control of storage pests (79.17%) and pre-harvest sprays (76.67%).
9. Around two-third of the mango harvesters did not follow sorting of fruits in plastic crates 68.33%), sorting of the fruits in fully ventilated rooms (70.00%).
10. Nearly fifty per cent of the respondents noticed in low category of overall adoption.

Constraints in adoption of post-harvest management practices

1. A high percentage of respondents expressed the constraints of labour shortage and high wages (75.00%) and lack of technical knowledge and guidelines (71.00%).
2. Around sixty per cent of growers highlighted the problems of more time consumed for adopting technologies (63.33%) and high fluctuation in market prices (62.50%).
3. Around fifty per cent of respondents experienced the constraints for non-availability of credit (54.17%), high cost of pesticides (53.37%) and non-adaptability of recommended post-harvest practices (51.66%).

Implications of the findings of the study for field extension work

1. The more incidence of knowledge and adoption gap calls for strengthening technology transfer by the concerned extension agencies.
2. Efforts to popularize appropriate post-harvest equipments and machinery to overcome shortage of labour.
3. There is a need for appropriate interventions from the development departments, policy makers and other concerned agencies in helping the farmers for adopting post-harvest management practices and marketing of processed products.
4. Efforts to popularize organic method of cultivation in view of high cost of chemical inputs.
5. Establishing a strong network of mango growers, scientists, extension workers, marketing agencies and other stake holders to tackle the problems involved in production, post-harvest management and marketing of the produce.

Suggestions for the future research

The present study was confined to only two districts of Karnataka due to limitation of time and cost of researcher. Hence, findings of this study could not be generalized to other regions. Therefore, a comprehensive research study covering major mango growing districts of the state need to be carried in order to draw a comprehensive generalization and to make concrete recommendations for planners and policy makers to arrive at concrete scenario of post-harvest management in mango.

A detailed study of established mango growers considering their entrepreneurial characteristics has to be carried out to provide a clear cut information of mango growers which are useful for designing effective extension activities and entrepreneurship development programmes.

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APPENDIX

Appendix I: State-wise area, production and productivity of mango during 2007-08

Sl. No.	State	Area (000 ha)	Production (000 Mt)	Productivity (ha/Mt)
1.	Andhra Pradesh	483.5	3865.2	8.0
2.	Uttara Pradesh	265.9	3256.6	12.2
3.	Karnataka	132.0	1337.7	10.1
4.	Gujarat	109.6	930.1	8.5
5.	Bihar	142.2	870.4	6.1
6.	Tamil Nadu	136.6	753.6	5.5
7.	Maharashtra	455.8	710.9	1.6
8.	West Bengal	80.9	623.3	7.7
9.	Kerala	76.7	445.4	5.8
10.	Orissa	148.2	251.8	1.7
11.	Others	174.1	747.0	4.3
	Total	2205.6	13792.1	6.3

Source : Anonymous (2009)

Appendix II: District-wise area, production and yield per hectare of mango in Karnataka during 2004-05

District	Area ('00 ha)	Production ('00 tonnes)	Yield (kg/ha)
Bagalkot	1.6	2.6	1696
Bangalore Rural	203.0	695.2	3425
Bangalore Urban	15.1	162.7	10756
Belgaum	15.5	13.3	856
Bellary	6.2	8.8	1415
Bidar	4.8	48.9	10214
Bijapur	1.7	5.7	3277
Chamarajnagar	5.0	5.7	1142
Chikkamagalur	23.4	105.2	4497
Chitradurga	4.0	58.5	14480
Dakshina Kannada	48.0	84.6	1765
Davanagere	19.0	168.5	8893
Dharwad	29.0	75.9	2614
Gadag	4.6	49.8	10758
Gulbarga	10.0	52.3	5229
Hassan	21.3	84.4	3958
Haveri	8.9	58.9	6641
Kodagu	0.3	2.1	6814
Kolar	337.7	622.0	1842
Koppal	5.6	4.8	862
Mandya	25.6	73.9	2889
Mysore	29.5	487.1	16494
Raichur	3.7	3.4	912
Shimoga	23.9	70.5	2952
Tumkur	110.3	174.5	1582
Udupi	13.6	15.6	1151
Uttara Kannada	12.2	43.1	3530
Karnataka	983.5	3178.2	3232

Source : Anonymous (2009)

Appendix III: Taluka-wise area and production of horticulture crops in Dharwad district during 2007-08

Sl. No.	Name of the taluk	Mango			
		Area (ha)	Production (t)	Yield (t/ha)	Value (Rs. in lakhs)
1.	Dharwad	2618	31416	12	22000
2.	Hubli	668	8016	12	22000
3.	Kalaghatgi	715	8580	12	21000
4.	Kundagol	114	1026	9	20000
5.	Navalagund	-	-	-	-
	Total	4115	49038		

Source : Annual Report, 2009, Dept. of Horticulture,

Appendix IV: Taluka-wise area and production of horticulture crops in Belgaum district during 2007-08

Sl. No.	Name of the taluk	Mango			
		Area (ha)	Production (t)	Yield (t/ha)	Value (Rs. in lakhs)
1.	Athani	40.17	472.33	11.76	84.96
2.	Bailhongal	575.00	5750.00	10.00	94.70
3.	Belgaum	1385.00	24930.00	18.00	4487.40
4.	Chikkodi	50.00	350.00	7.00	56.00
5.	Gokak	106.00	1484.00	14.00	248.33
6.	Hukkeri	93.40	934.00	10.00	140.10
7.	Khanapur	1489.00	14890.00	10.00	2978.00
8.	Raibag	98.00	1176.00	12.00	211.68
9.	Ramdurg	55.70	111.40	2.00	13.37
10.	Saundatti	72.00	576.00	8.00	115.20
	Total	3964.27	50673.73	12.78	84.29.74

Source : Annual Report, 2009, Dept. of Horticulture,

Appendix V: Export of mango from India during 2007-08

Sl. No.	Country	Quantity (kg)	Value (Rs.)
1.	UAE	22469623	632093163
2.	United Kingdom	2575374	198166039
3.	Bangladesh	17063596	159545893
4.	Nepal	7550890	63630106
5.	Saudi Arabia	1488949	45977183
6.	Kuwait	460836	30617833
7.	United States of America	142489	19577262
8.	Bahrain	474234	17569923
9.	Singapore	340319	16875000
10.	Germany	343804	14406342
11.	Others	1440687	75735026
	Total	54350801	1274175770

Source : Anonymous (2009)

Appendix VI: Interview Schedule

A Study on Knowledge and Adoption of Post-Harvest Management Practices among the Mango growers of North Karnataka

Part – I

I. General information

1. Name of the Farmer :
2. Name of the village :
3. Name of the taluka :
4. Name of the district :

II. Personal characteristics

1. Education : a) Illiterate b) Primary school c) Middle school d) High school
e) PUC f) Graduate g) Post-graduate

2. Size of the land holding (acres)

Irrigated :
Dryland :
Total :

Cropping pattern followed in the last year

Name of the crop cultivated in acre

Unit/Patch	Rainfed		Irrigated		
	Kharif	*Rabi*	*Kharif*	*Rabi*	Summer
I					
II					
III					
IV					

4. Farming experience : _____years

5. Experience in mango cultivation : _____years

6. Mass media use

Sl. No.	Media	Owner/ Subscriber	Agri programme/Type of information / information columns referred / viewed	Frequency of use/for getting Agril. information		
				Regular	Occasional	Never
1.	Radio					
2.	Newspaper					
3.	Farm magazine (name)					
4.	TV					
5.	Any other (specify)					

7. Risk orientation

Please indicate whether you agree or disagree with the following statements by putting mark in the columns agree or disagree for the statement

Sl. No.	Statement	Response	
		Agree	Disagree
1.	A farmer should grow large number o crops to avoid greater risks involved in growing one or two crops		
2.	A farmer should rather take more o a change in making a big profit than to be content with a smaller but less risky profits		
3.	A farmer who is willing to take greater risks than the average farmer usually have better financial condition		
4.	It is good for a farmer to take risks when he knows his chance of success is high		
5.	It is better for a farmer not to try new farming methods unless most other farmers have used them with success		
6.	Trying an entirely new method in farming by a farmer involves risk, but it is worth		

8. Extension participation

Sl. No.	Extension activity	Participated		Extent of participation		
		Yes	No	Regular	Occasional	Never
1.	Training programme					
2.	Demonstration					
3.	Field day					
4.	Field visit					
5.	Extension group meeting/ interaction					
6.	Agriculture exhibitions					
7.	Krishimela					
8.	Educational tour/ Exposure					
9.	Others (specify in any)					

9. Achievement motivation : by putting mark in the column agree, undecided or discharge for the statement

Sl. No.	Statement	Agree	Undecided	Disagree
1.	Work should come first even if one cannot get proper rest in order to achieve ones goals			
2.	It is better to be content with whatever little			

	one has than to be always struggling for more (N)			
3.	No matter what I have done I always want to do more			
4.	I would like to try hard at something which is really difficult even if it proves that I cannot do it.			
5.	The way things are now-a-days, discourage one to work hard (N)			
6.	One should succeed in occupation even if one has to neglect his family			

10. Economic motivation

You are requested to indicate your agreement as Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA), Strongly Disagree (SDA) to the following statements

Sl. No.	Statements	SA	A	UD	DA	SDA
1.	A rural youth should work towards large yields and economic profit					
2.	The most successful rural youth is one who makes the most profit					
3.	A rural youth should not only grow cash crops, but should take up agrobased subsidiary enterprise to increase monitory profit in comparison to growing only food crops for home consumption					
4.	A rural youth should try new enterprise which may earn more money					
5.	It is difficult for the rural youth children to make good start unless he provides them with economic assistance					
6.	Rural youth must earn their living but the most important thing in life cannot be defined in economic terms					

Part – II

Knowledge Level of Post-Harvest Management Practices of MANGO

I. Maturity and harvesting

1. The duration taken for maturity of mango fruits is ……..days.
2. Which method / chemical is recommended to reduce the post-harvest losses.

   a) Ethylene b) Bavistin c) None
3. Among below mentioned types of propagated plants, which type of propagation material yields early?

   a) Grafted plants b) Monoembryonic seedlings c) Don't know
4. The best way to identify the maturity o the crop, fruits are to be looked for

   a) Peel and pulp colour b) Shape and size

   c) Placing fruits in a bucket of water (specific gravity)
5. The ideal time for harvesting of the crop is,

   a) Cooler part of the day b) Hot period of the day c) Don't know
6. In which of the following method of harvesting, fruits damage is noticed to the less extent?

   a) Dropping on ground b) Using fruit picker c) Beating with stick
7. The fruits which cannot be reached from the ground can be harvested by:

   a) By beating wit stick b) By using picking pole c) Don't know
8. To know the maturity, fruits have to be dipped in ……..solution of …… concentration a)
9. The variation in fruit maturity is noticed due to:

   a) Pollination and flowering period occurs over many days b) Moisture stress

   c) Don't know

II. Pre and post-harvest treatments

1. The sap burning during harvesting can be avoided by

   a) Dipping in the 1% solution of calcium hydroxide solution

   b) Lime solution (pH 2.5) c) Dipping in plain water d) All the above

2. Which of the following technique reduces the latex exudation

   a) Harvesting by secateurs and cutting the stem 3 cm away from fruit

   b) By hand picking c) Don't know

3) Washing of the fruits after the harvest helps to

   a) Improve the appearance and to remove the sap b) To reduce spoilage

   c) Don't know

4. Fruitfly infection can be avoid by following

   a) Vapour heat treatment with Ethylene dibromide b) Calcium oxide

   c) Don't know

5. Which are the different methods to remove the field heat

a) Air cooling b) Hydro cooling c) Vaccum cooling

c) All the above

6. Which is the major cause for the post-harvest loss

a) Infection caused by micro-organism b) Improper packing

c) Improper handling

7. Waxing o the fruits helps in preventing

a) Moisture loss and respiration b) Decay c) Don't know

III. Grading and sorting

1. The grading of the fruits is most important to maintain the uniqueness for ……..

a) Better marketing b) To reduce spoilage c) Don't know

2. The practice of grading and sorting of fruits helps to remove

a) Diseased and immature fruits b) Bruised and ripened fruit

c) Both a and b

IV. Storage

1. In which method of storage, more fruit loss is noticed?

a) Heaping b) Keeping in plastic tray c) Don't know

2. The best method of storage of mango fruits is to keep fruits in plastic tray (True/False)

3. The optimum temperature for the storage of the mango fruits?

a) 1 – 2^0C b) 5 – 10^0C c) Above 15^0C

4. Chilling injury leads to……

a) Reduction in fruit quality and increase spoilage b) Inhibition of ripening

c) Don't know

5. For increasing shelf life of the fruits which of the following method is advocated?

a) Storing at very low temperature b) Spraying with ethepon

c) Wax coating

V. Packing

1. Which point is to be borne in mind while transporting to distance market?

a) proper packing b) Type of transport c) Care during transport

2. Ripened fruit is the correct stage for packing of fruits for distant market? Yes/No

3. Which is the good packing material for the mango?

a) Wooden crates and CFB b) Gunny and bamboo basket c) Don't know

4. Which of the following is the ideal cushioning material for packing?

a) What and paddy straw b) Paper shreds c) Don't know

5. Which chemical is used while packing of the fruits?

a) Calcium carbide b) Potassium chloride c)Potassium permanganate

6. While packing fruits have to placed in what position?.....

VI. Ripening

1. For better ripening the fruits are to be ripened at ……

a) 19.4 – 21.1^{0}C b) 38^{0}C c) 42^{0}C

2. The ideal temperature for degreening of the fruits is……..

a) 15^0C b) 27^0C c) 35^0C

3. The ideal relative humidity for degreening of the fruits is……

4. For artificial ripening of fruit which gas is harmful…….

5. Which is the chemical used for degreening of the fruits?

a) Ethylene b) GA_3 c) NAA

VII. Transportation

1. While transporting fruit damage due to multiple handling can be minmized by

a) Palletisation b) Manual handling c) Does not need any care

2. Under which transportation system pre-cooling is essential

3. The best method o transportation of fruit for longer distance is,

VIII. Processing

1. Which variety o mango fruit is best suited or processing?

a) Alphanso b) Mallika c) Totapuri d) Any variety

2. Which are the products prepared by processing of the mango?

a) Jam, Juice & Pickles b) Wine c) don't know

3. Which stage of the fruit is best suited or preparation of pickles?

a) Unripened b) Ripened c) Over ripened

4. Which stage of fruit is best suited or preparation of products like jam, jelly, juice, canning?

a) Unripened b) Ripened c) Over ripened

IX. Control of the storage pests and diseases

1. Generally which chemical is used to avoid pathogen infection……..

2. The symptom of anthracnose infection is……..

3. The mode of infection of stem end rot disease in mango is……

a) Through cut stems b) Through leaves c) Physical damage

4. Which disease spreads / appears after slicing the fruit?

a) Jelly seed b) Anthracnose c) None

5. Appearance o water translucent tissue is the characteristics of jelly seed. Yes/No

6. Many countries have seen restricted for mango fruit importing mainly due to infection of

a) Fruit fly b) Stone weevil c) Shoot fly

7. The symptoms of spongy tissue are …….

8. Which variety of mango is susceptible spongy tissue

a) Pairi b) Alphanso c) Totapuri

9. The cause of spongy tissue is

a) Ca deficiency b) Fungi c) Conventional heat

Adoption of post harvest management practices in mango by the farmers

Sl. No.	Items of post-harvest practices	Details of practices followed by the farmers	Level of adoption		
			Fully adopted	Partially adopted	Not adopted
I.	Maturity and harvesting				
1.	Which mango variety was planted form the point of good market / processing (Alphanso / Mallika)				
2.	Judging maturity (specific gravity method)				
3.	Harvesting the crop (fully matured)				
4.	Method of harvesting (hand picking / using picking poles)				
5.	Time of harvesting (cooler part of the day)				
II.	Pre and post-harvest treatments				
1.	Measures for controlling sap burning				
2.	Pre-harvest sprays used [Topsin-M (0.1%) or Bavistin (0.1%)]				
3.	Washing of the fruits after harvest (hot water treatment)				
III.	Grading and sorting				
1.	Te practices followed for grading and sorting of the fruits Size…… Weight…….. Colour…….				
2.	Method of grading of the fruits (manual grading / scientific grading)				
IV.	Storage				
1.	Where the fruits will be stored (on the ground / plastic crates)				
2.	Type of storage room used (closed with fully ventilated room / godown)				
V.	Packing				
1.	Method for packing of fruits (wooden crates / CFB boxes)				
2.	The cushioning material used for packing (paper shreds)				
3.	Which chemical is used while packing of the fruits (potassium chloride / potassium permanganate)				

VI.	Ripening				
1.	Chemical used for artificial ripening (ethylene)				
VII.	Transportation				
1.	How do you transport the fruits for distant places (Train / Lorry)				
VIII.	Control of storage pest and diseases				
1.	Chemical method of control				
2.	Concentration and doses of chemical				
3.	Time of application of chemical				

A STUDY ON KNOWLEDGE AND ADOPTION OF POST-HARVEST MANAGEMENT PRACTICES AMONG THE MANGO GROWERS OF NORTHERN KARNATAKA

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ABSTRACT

The present study on knowledge and adoption of post-harvest management practices among the mango growers of Dharwad and Belgaum districts was conducted during 2008-09. Based on random sampling the selected 120 mango growers were interviewed using the structured interview schedule.

The results showed that one-third of respondents were noticed to possessed small holding (34.17%) and more 18 years of experience in mango cultivation (33.33%). More number of sample farmers were observed in medium level of achievement motivation (64.16%), followed by risk orientation (50.00%) and economic motivation (37.50%).

The overall knowledge about post-harvest management practices revealed that 45.00 per cent possessed medium level of knowledge. The detailed analysis of individual management practices indicated that a high per cent of respondents had knowledge of duration taken for fruit maturity (95.83%), identifying maturity of fruits (93.33%), storage techniques (91.67%) and suitable varieties for processing (90.00%). Similarly, majority of respondents possessed knowledge of ideal time for harvesting (87.50%), use of fruits pickers for harvesting (77.50%) and importance of grading and packing (72.50%).

The analysis of the overall adoption of post-harvest management practices showed that more number of the respondents (45.00%) were noticed in low adoption. Further, adoption of individual practices revealed that a high per cent of respondents adopted recommended variety (95.00%), followed by method of harvesting (71.67%) and time of harvesting (52.50%). But, cent per cent of respondents did not used potassium permanganate while picking of fruits.

The results of simple correlation showed that knowledge and adoption of post-harvest management practices were significantly determined by risk orientation, achievement motivation and economic motivation. A high percentage of respondents expressed the constraints of labour shortage and high wages (75.00%) and lack of technical knowledge and guidelines (71.00%).