

POST-HARVEST LOSSES AND MARKETING OF GRAPES IN PAKISTAN

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ABSTRACT

This study was designed to evaluate the overtime trends in grape acreage and production at the regional and national levels; to examine the marketing practices for grapes in the mountainous areas of Balochistan, Pakistan; and to estimate the post-harvest loss at various stages of grape marketing and distribution. Quetta, Pishin and Mastung districts were purposively selected for the study. Data were obtained during November 2005 from 33 producers and 31 market intermediaries/retailers by using pre-tested questionnaires. Significant quantity of grapes produce is traded to all parts of the country mainly to Punjab and Sindh provinces. Results indicated that farmers realize a higher price in distant market sales even while incurring higher marketing costs. The aggregate post-harvest losses in grapes range from 16-23%, depending on methods of marketing. Losses are mainly due to improper packing and transportation for having poor marketing infrastructure. The large shares of grape losses were borne by consumers. Majority of the producers were selling grapes to the contractors. The major constraints reported by the farmers were low price, high transportation cost and distant markets.

Key Words: Grapes, post-harvest losses, marketing channels

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INTRODUCTION

Pakistan is bestowed with a wide range of agro-climatic conditions, varied from tropical to temperate, allowing 21 different types of fruits to grow. The market value of these fruits produced during 2006-07 is estimated at about 97 billion rupees which is roughly 8% of agriculture value added in the year (GoP, 2007). During the same period, Pakistan earned 11.3 billion rupees from fruit exports, representing nearly one% of the total exports from Pakistan, and around 11% of the total amount earned from export of all raw agricultural commodities (GoP 2008). The total area under fruits is 0.833 million ha with the production of 6.011 million tons. Balochistan shares 30 and 14% of the total fruit area and production of Pakistan, respectively during 2006-07 (GoP 2007). Worldwide post-harvest fruit and vegetables losses are as high as 30 to 40% and even much higher in some developing countries. Reduction of post-harvest losses not only reduces cost of production, trade and distribution but also lowers the price for the consumer and increases the farmers' income. Utilizing improved post-harvest practices often results in reduced food losses, improved overall quality and food safety, and higher profits for producers and traders. It is estimated that 9 to 16% of the product is lost due to post-harvest problems during shipment and handling. Many factors contribute to post-harvest losses in fresh fruits and vegetables. These include environmental conditions, mechanical damage during harvesting and handling, improper post-harvest sanitation, and poor cooling and environmental control. Post-harvest losses during handling, transport, storage and distribution are the major problems in agrarian economy, especially in perishable fruits and vegetables. Besides resulting in low per capita availability and huge monetary losses, these increase transport and marketing costs also (Subrahmanyam, 1986).

There are growing concerns about the low productivity of grapes in the country as compared to developed and developing countries, especially in comparison to our neighbors like India. This signifies a need to identify factors responsible for low grape productivity. Markets for agricultural products function inefficiently. There are generally great differences between prices paid by consumers and those received by producers. It is generally perceived that marketing agents exploit producers and consumers by charging a fixed and high margin on their investment (Ali, 2000). Balochistan is the largest province but has the poorest post-harvest and marketing infrastructure. This resulted in higher post-harvest and transportation losses (Nisar *et al.*, 2002; Sheikh, 1996; and Iqbal, 1996). A substantial quantity of fresh fruits is lost at various stages of marketing due to non-availability of suitable post-harvest technologies and infrastructure. The quantum of loss is influenced by several factors like method of harvesting, physical damage during handling and transport, physiological decay, water loss, or sometimes simply because there is a surplus in the marketplace and no buyer can be found. Besides resulting in low per capita availability and huge monetary losses, these increase transport and marketing costs as well (Subrahmanyam, 1986).

Keeping in view the above mentioned facts, the study is designed to evaluate the overtime trends in grape acreage and production at the regional and national levels; to examine the marketing practices and evaluate the post-harvest losses at various stages of grape marketing in the mountainous areas of Balochistan, Pakistan; and to draw implications for promoting grape production through better management practices.

MATERIALS AND METHODS

This study is based on primary and secondary data. Primary data were directly obtained from farmers through well-structured and pre-tested questionnaires while secondary information on grape production and marketing was collected from government departments and relevant sources. For confirmation of survey results, personal observations and informal surveys were conducted at different levels of the study.

The survey for the present study was conducted in November 2005. The leading producing areas are Quetta, Pishin and Mastung districts of Balochistan. Districts Pishin lie in the north of capital city of Quetta while district Mastung is located in south of Quetta.

In all, 33 grapes growers were randomly selected. Fifteen grape farmers (36.59%) were selected from Pishin, 16 (39.02) from Quetta and only ten (24.39%) from Mastung districts. Data were also collected from fruit retailers for first hand information about losses. Thirty one retailers consisting of shopkeepers and pushcarts were randomly selected inside and around the city. For calculating the grape losses in the value of produce, gross price received by the farmers was used, as they would have realized the return had there been no loss. Thus, the net farmers' price is expressed mathematically as follows (Murthy *et al.*, 2004) to calculate the losses act as with the following formula.

$$NP = GP_F - \{C_F + (L_F \times GP_F)\}$$

or

$$NP_F = (GP_F) - (C_F) - (L_F \times GP_F)$$

Where

NP_F is net price received by the farmers (Rs. kg^{-1})

GP_F is gross price received by the farmers or wholesale price to farmers (Rs. kg^{-1})

C_F is the cost incurred by the farmers during marketing (Rs. kg^{-1}),

L_F is physical loss in produce from harvest till it reaches assembly market (kg^{-1})

RESULTS AND DISCUSSION

Grape (*Vitis vinifera*) is one of the major fruit crops mainly grown in high elevated valleys of Balochistan. A soil having low water holding capacity i.e. sandy loam is the best for its growth. Climate and soil of the survey areas is considered ideal for the production of high quality deciduous fruits. The leading grape varieties grown are: Haita, Kishmishi, Shundokhani, Sahibi and Shekhali.

Table I Area, production and yield of grapes in Pakistan and Balochistan 1991-2007

Years	Area (000 ha)		Production (000 Tons)		Productivity (Kg/ha)	
	Pakistan	Balochistan	Pakistan	Balochistan	Pakistan	Balochistan
1990-91	3.2	3.1	32.8	31.8	10250	10258
1991-92	3.5	3.4	35.5	34.3	10143	10088
1992-93	3.8	3.7	37.6	36.3	9895	9811
1993-94	8.1	8.0	40.3	39.0	4975	4875
1994-95	8.2	8.1	42.9	41.5	5232	5124
1995-96	8.4	8.3	72.0	70.7	8571	8518
1996-97	8.5	8.4	74.1	72.8	8718	8667
1997-98	8.7	8.6	74.3	73.0	8540	8488
1998-99	8.9	8.7	75.8	73.8	8517	8483
1999-00	10.4	10.2	40.3	38.2	3875	3745
2000-01	12.5	12.3	51.1	48.8	4088	3968
2001-02	12.7	12.5	52.6	50.3	4142	4024
2002-03	12.7	12.5	51.8	49.5	4079	3960
2003-04	12.8	12.6	50.8	48.4	3969	3841
2004-05	13.0	12.8	49.1	47.7	3777	3727
2005-06	13.0	12.8	48.8	47.5	3754	3711
2006-07	13.8	13.6	46.5	45.2	3370	3324

Source: Agricultural Statistics of Pakistan, 2006-07

The main grape producing areas are Quetta, Pishin, Killa Abdullah, Mastung, Kalat, Loralai and Zhob districts. Culture of mixed orchards in the area was dominated, it was noticed that eighty-five% of the farmers practiced mixed orchards. Grape orchards were inter-cropped mainly with apples (49%), apricot and pomegranate (21%) and the remaining 15% with plum, peaches, etc in the sample area. The fruit is consumed fresh and in a dried form called Monaka and Kishmish.

Trends in Grape Area and Production

Grape is cultivated over an area of 13.8 thousand hectares with an annual production of 46.5 thousand tons. Balochistan contributes 99 and 97% to overall grape area and production of Pakistan (GoP 2007). Grape area and production during the last one and a half decade increased at the rate of 9.6 and 2.2% per annum, respectively due to rural electrification, which resulted in extensive installation of tube-wells whereas the yield decreased significantly at an alarming rate of about 7% during the same period Table II.

Table II Growth rates (%) in area, production and yield of grapes in Pakistan and Balochistan 1991-2007

Years	Area		Production		Productivity	
	Pakistan	Balochistan	Pakistan	Balochistan	Pakistan	Balochistan
1991-2001	14.6	14.8	4.5	4.4	-8.8	-9.1
2001-2007	1.7	1.7	-1.6	-1.3	-3.2	-2.9
1997-2007	5.0	4.9	-4.6	-4.7	-9.1	-9.1
1991-2007	9.6	9.7	2.2	2.2	-6.7	-6.8

The area under grape cultivation has increased considerably from 3200 ha in 1990-91 to 12500 ha in 2000-01 showing an increase of 291% with an annual growth rate of 14.6%%. However, subsequently during the period 2001-02 to 2006-07, this pace could not be maintained. The growth rate fell to 1.7%% per annum. After 2002-03, the area under grape cultivation is not expanding fast Table II. If more attention is focused on mechanization, labour requirements and good crop management, the production of vine can be further increased by another 25%. Grape productivity shows declining trend during the last one and a half decade. Although, the returns per unit area of land are very high with grape cultivation, the area under grapes is not expanding fast owing to the high initial cost of establishing the vineyards and high recurring cost of production. The risk of losing a crop due to unprecedented changes in weather is also very high. Efforts are needed to extend grape cultivation to newer areas and improve its productivity and quality. The development of agriculture sector in highland Balochistan depends on the availability of groundwater, which is indiscriminately pumped out and results in the sharp decline of underground water table.

Table III % Changes in area, production and yield of grapes in Pakistan and Balochistan 1991-2007

Years	Area		Production		Productivity	
	Pakistan	Balochistan	Pakistan	Balochistan	Pakistan	Balochistan
1991-2001	290.6	296.8	55.8	53.5	-60.1	-61.3
2001-2007	10.4	10.6	-9.0	-7.4	-17.6	-16.2
1997-2007	62.4	61.9	-37.2	-37.9	-61.3	-61.7
1991-2007	331.3	338.7	41.8	42.1	-67.1	-67.6

It was found that *Haita*, *Kishmishi* and *Shundokhani* were the most popular commercial grape varieties grown by the farmers in the area. These varieties were grown on 20, 21 and 41% of the total grape area, while *Sahibi* and *Shekhali* varieties were grown almost equally on 18% of area. *Haita*, *Kishmishi* and *Shundokhani* were considered high yielding varieties. However, *Shundokhani* grapes were priced more as compared to other varieties. Tielu and Rees (1996) projected the shortages are expected to be greatest for premium varieties which will experience an upward pressure on prices, while an abundance of grapes from non-premium and minor varieties is expected to result in downward pressure on the prices of these varieties over the projection period. The average yield of all varieties taken together was 6,988, 5,275, 3,056, 4,774, and 3,811 kg per acre of *Haita*, *Kashmish*, *Shundokhani*, *Sahibi* and *Shekhali* respectively. In district Quetta the yield per acre was 5,315 kg, which was significantly higher than that of Pishin 4,601 kg and Mastung 4,100 kg Table IV.

Table IV Area (acre) and yield (Kg per acre) of different grape varieties in the area

Variety	Pishin		Quetta		Mastung		Overall	
	Area	Yield	Area	Yield	Area	Yield	Area	Yield
Haita	2.1	4,366.6	3.4	8,111.9	--	--	2.9	6,988.4
Kashmish	4.0	4,440.0	2.0	6,383.5	3.7	4,100.0	3.1	5,274.6
Shundokhani	10.1	4,600.0	1.8	4,568.0	--	--	6.0	4,584.0
Sahibi	1.0	5,300.0	2.0	4,189.3	--	--	1.3	4,774.0
Shekhali	1.0	4,300.0	1.7	3,322.6	--	--	1.4	3,811.0
Average	3.94	4,601.0	2.2	5,315.0	3.7	4,100.0	4.9	5,081.0

Source: Survey data, 2005

There is lot of scope to substantially improve its productivity by practicing available production technology. However, much is still desired as far as the productivity is concerned, therefore, emphasis is on improving the productivity and quality. Good crop management and better utilization of farm resources can substantially increase the grape productivity in Pakistan, which is 4 to 5 time less than our neighbour India. Development and dissemination of cost effective production and post harvest technologies like trickle irrigation system, high yielding, and drought and disease resistance varieties of grapes and cold chain/storage facilities are urgently required.

Gross Income

The output prices of different grapes varieties were recorded from all sites. The yields per acre were multiplied by their respective selling prices to calculate the gross income as indicated in Table V.

Table V Variety wise gross income of the sample respondents in the study area

Variety	Price/kg	Pishin		Quetta		Mastung		Overall	
		Yield (Kg/ac)	Value(Rs/ac)	Yield (Kg/ac)	Value (Rs.)	Yield (Kg/ac)	Value (Rs.)	Yield (Kg/ac)	Value (Rs.)
<i>Haita</i>	17.0	4366.6	74,233	8111.9	137903	--	--	6,988.3	118802
<i>Kashmish</i>	20.0	4440.0	88,800	6383.5	127670	41,00.0	82000	5,274.5	105492
<i>Shundokhani</i>	24.0	4600.0	110,400	4568.0	109632	--	--	4,584.0	110016
<i>Sahibi</i>	14.0	5300.0	74,200	4189.3	62840	--	--	4,774.0	66425
<i>Shekhali</i>	12.0	4300.0	51,600	3322.6	398720	--	--	3,811.0	45732
<i>Average</i>	--	--	79,847	--	95583	--	82000	--	89293

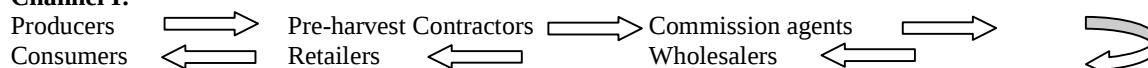
Source: Survey results, 2005

Marketing Practices and Channels

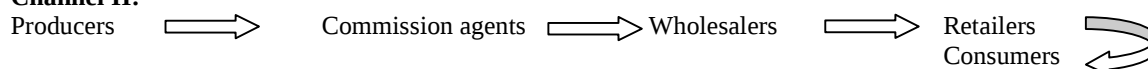
The marketing of grapes begins when the produce leaves the farm and ends when it reaches to the final consumers. It is more than buying and selling. It is rather a series of important business activities that transform a farm producer's product into a number of finished products desired by the consumer. The results indicate that ninety% of the farmers sell their orchards to pre-harvest contractors while the remaining 10% farmers market through direct sale of the produce because direct sales benefit the producers more than contract sales. Generally, low grade grapes are marketed in Quetta while the higher grade grapes are traded to other provinces, mostly Sindh and Punjab.

Marketing channel is a process of selling of different commodities at different stages, which involve a number of traders like producers, contractors, commission agents, wholesalers and retailers. The facts cannot be denied that a long chain of traders make marketing operation less efficient and more costly, as each trader in this chain has his role and share. Packing material and transportation costs are the major components of the marketing costs (Singh, 1994). Two most common distribution channels observed were:

Channel I:



Channel II:



Grape/Raisin Value Chain Participants

Producers

Farmers in the surveyed area comprising Quetta, Pishin and Mastung districts grow 82% of the grapes in Pakistan. The most common varieties of grapes grown are *Haita*, *Kishmishi*, *Shundokhani*, *Sahibi* and *Shekhali*. About 87% of the harvest ultimately ends up as fresh table grapes while the remaining 13% dried and sold as raisins because the soft skins of these grapes make them especially difficult to transport fresh.

The average farm size of the grape producers in the survey area is 40 acres of which 22 acres is under orchards and crops are grown on the remaining 18 acres. Out of the total orchard area, grapes are cultivated on 14 acres. Cultivating grapes is time intensive and demands considerable expertise to achieve optimal yields. Without proper management yields can fall as much as 70%, and without adequate inputs can decline by more than 90%. The low yields were due to several factors: poor pruning and training techniques, inadequate fertilizer utilization, poor

irrigation systems, little pest control and lack of resources to purchase inputs. About 90% producers of the area prefer to sell their produce at the farm gate to contractors due to having little or no access to market price information, lack of marketing skills and to avoid inconveniences confronted during marketing.

Contractors

The presence of contractors is a typical characteristic of grape marketing in Balochistan. Contractors generally buy the grape orchards from producers mostly at the flowering stage. Contractors and farmers negotiate various payment schemes. Typically, a contractor will come by the farm as the vines begin to fruit and offer the farmer a contract to buy at harvest time. Normally, they pay a token money at the time of negotiations to tie the producers. Farmers usually will not receive full payment until after the trader has sold the grapes, and this payment will be based on the price the trader sells for, discounted for a percentage of products lost to spoilage and handling.

Market Traders/Commission Agents

Traders or commission agents provide a critical service in amassing sufficient quantities of product from many farmers for marketing to larger traders, wholesalers and processors/retailers. They also play a role in quality control. They contract for farmers' harvest in advance, and in most cases bring in the labor and packaging to conduct the harvest and transport it to their buyers. Typically, the trader does not pay the farmer until after he has sold the product, minimizing his risk. Remote farmers have little leverage when negotiating price with traders, as they do not have access to market price information nor do they cooperate for collective bargaining power. There are usually substantial post-harvest losses due to extreme temperature, contamination, bruising and spoilage. The commission agent charges commission at the rate of 4% and other charges including market fee, transportation cost, labor charges and others.

Wholesalers

Wholesalers of grapes and raisins operate between commission agents and retailers. Wholesalers operate exclusively from the larger market towns and typically buy from many traders who in turn may have bought their produce at the farm gate. Wholesalers work closely with the commission agents. He buys the products through the commission agents and sells in smaller lots to the same as well as distant markets to his buyers, retailers and consumers. Sometimes, he withholds the stock and creates shortage to manipulate prices. The improvement in packing also helps him in getting higher price.

Retailers

Fresh grapes are obviously only seasonally available whereas the raisins are widely available throughout the year. After purchasing the grapes from the wholesaler, the retailer takes the produce to his shop or site where cleaning and standardizing are made by him. During this process small losses occur. The retailers are of different types such as a big central market operator, small street/shop vendor, pushcart or other small mobile peddler. Aside from the retailers in the markets and small shops, farmers and traders may themselves engage in some direct selling to end consumers. For example, farmers may take a small cartload of grapes/raisins to the main road to sell to passerby. Likewise traders may retail some of their product in the district market directly to consumers.

Post-Harvest Losses

Most losses of fresh produce occur between leaving the farm and reaching the consumer. These losses may be caused by complete wastage of the product or by lower prices due to a reduction in quality. The cost of these losses is also important as the value of the product increases several fold from the farm gate to the final consumer, so postharvest losses are even more significant.

The major post harvest losses in grapes reported by producers, contractors and retailers during early maturity, before and after harvesting were mainly occurred due to wind velocity, poor packing, handling and transportation, etc. It is estimated that defects and inadequate facilities in post-harvest handling, transport, storage and marketing cause up to 16-23% loss of grapes in Pakistan with an average of 20.5% of the total crop. The fresh grape losses observed due to early maturity are 2% and before harvesting loss is also 2%. During harvesting the fresh grape loss experienced is 4.8%. Grape fruit losses estimated during transportation are 5.2% while the fresh grape losses during marketing and distribution are 6.5%. It is worthy to mention that if in a crate there is only "A" grade grape; the retailer will get much higher net revenue with the same price as of multiple and poor grade crates. It was observed from the survey that on an average a crate has 17% damaged grapes and out of these 11% was not consumed and is wastage. Furthermore, in a multiple and poor grade crate of grapes there is an additional cost on waste product of grape.

During harvesting stage the fruit losses are quite high, so with care while harvesting and training of harvesters the losses can be minimized or decreased. The transportation cost can be decreased by good packing of fruit and also by taking care while loading and unloading. Post harvest handling is the final stage in the process of producing high quality fresh produce. It presents many challenges to be able to maintain a level of freshness from the field to the dinner table. A grower, who can meet these challenges, will be able to expand his marketing opportunities and be better able to compete in the marketplace. Lack of proper training on harvesting and handling practices in workers employed at the 'on farm packing houses' of growers has adversely affected the post storage shelf life. Though postharvest management technology is available in certain sectors, the supply chain inefficiency and inadequate cold chain infrastructure at production sites to maintain the cold chain from harvest to cold storage are also the main impediments besides the bad roads and inadequate and inconsistent power supply.

CONCLUSION AND RECOMMENDATIONS

Appropriate production practices, careful harvesting, and proper packaging and transport all contribute to good produce quality. In order to reduce post harvest losses of grapes, there is a need for better handling, packing and grading. Policy makers need to know more about the costs and benefits of investment for loss reduction. The extra cost afforded by the consumer in the form of multiple and poor grading can be reduced by proper packing and grading. In this connection, there is an urgent need to develop the confidence of both producers and retailers on grading. Beside this, quality cannot be improved after harvest, only maintained; therefore it is important to harvest fruits, at the proper stage and size and at peak quality. Immature or over mature produce may not last as long in storage as that picked at proper maturity.

Long chain of intermediaries makes marketing operation less efficient and more costly, as each intermediary in the chain receives his share. Low prices, high transportation costs and distant markets were claimed major constraints in grape marketing. This distortion in the post harvest handling and packing of grape is ultimately borne by the consumers. The major bulk of the produce is harvested in August-September, but as cold storage facilities are currently inadequate there are frequent market gluts. About 21% of the grapes grown in Pakistan (9.8 thousand tons amounting to US \$ 3.25 million) get wasted annually due to gaps in the cold chain such as poor infrastructure, insufficient cold storage capacity, unavailability of cold storages in close proximity to farms, poor transportation infrastructure, etc. This results in instability in prices, farmers not getting remunerative prices and rural impoverishment. Enough attention needs to be paid to adequately address the pre-harvest and post-harvest issues for boosting the levels of production. Operating costs for cold storage units are higher compared to developed countries. Energy expenses make up significant part of the total expenses for cold storages compared to the West. These factors make setting up cold storages difficult, unviable and uneconomical. About 30-35% of the losses can be reduced by transporting the freshly harvested grapes in refrigerated containers thus closing this gap in the cold chain. Setting up of modern terminal markets in the country will help in establishing an efficient supply chain right from the farm gate to the consumer/processor.

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