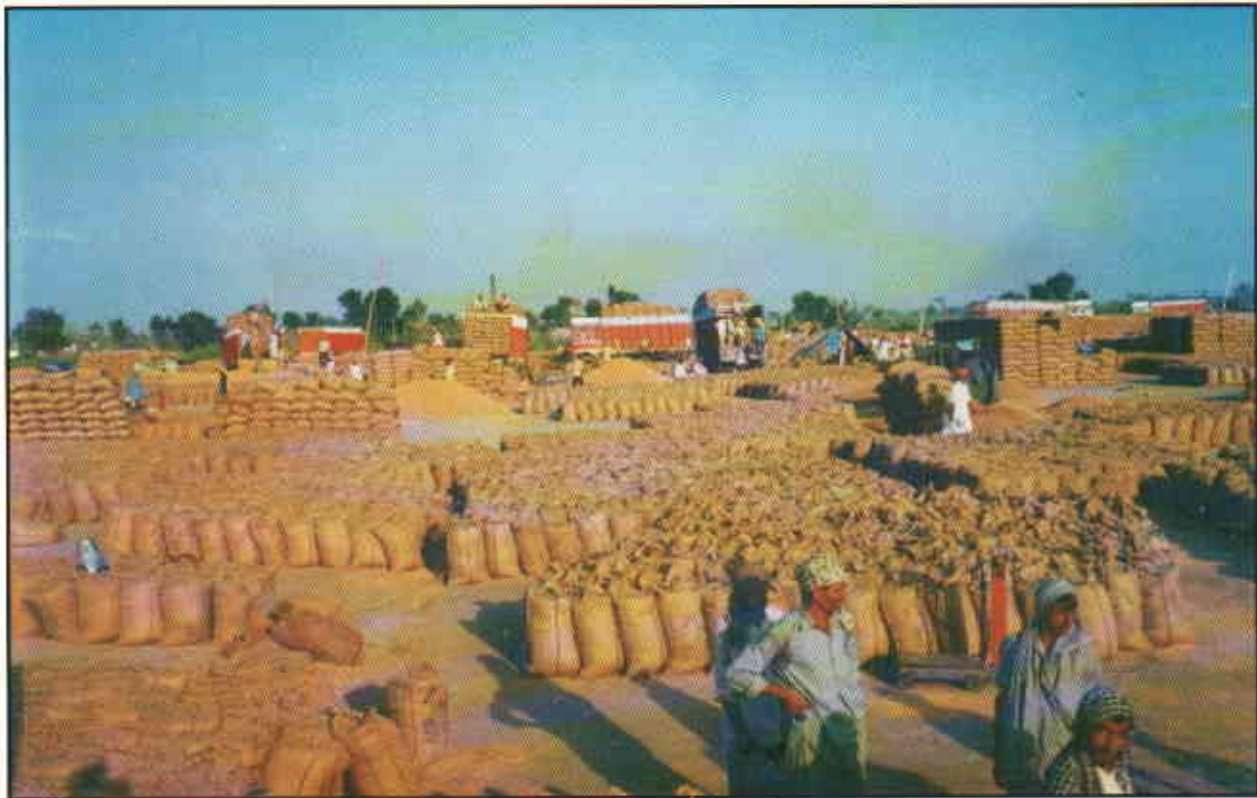


Rice Production Marketing And Export



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**DIRECTORATE OF AGRICULTURE
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Foreword


Improved Agricultural Marketing Information system is key to the development of Pakistan's Agrarian Economy. Fully cognizant of the fact, Government of the Punjab in Agriculture Department is implementing a Programme for improvement of Agricultural Marketing Information System to facilitate Agribusiness with special emphasis on exports. The objectives are as follows:

- **Collection of data on domestic production to monitor the crop situation to find out estimation Marketable and Exportable Surplus.**
- **To collect information on International Production and Trade.**
- **To provide Information to the policy maker to facilitate export of Agriculture Crop/Produce to find out potential export markets to accelerate export.**
- **Maintenance of database on vital information regarding domestic and International Production, Trade, Consumption needs and quarantine requirements/ standards of Agriculture Crop.**
- **To discuss the WTO issues and Constraints under its regime.**

This report relate to Rice crop through a planned effort, keeping in view the above objective. Available information is updated, further required data has been collected and processed.

The information collected has been compiled into a booklet form to be used as reference/benchmark by all the stakeholders' viz. producers, processors, traders and exporters to enable them to plan an effective role in the World's production, productivity and export. The efforts made by Miss. Shakera subhani Agricultural Officer Headquarter office & Mr. Muhammad Irfan Bhatti analyses and composition to compile the information is highly acknowledged.

To update the information is regular activities. All the stakeholders can obtain the latest information from the Directorate through toll free telephone Number (0800-51111). Any suggestion for improving the format and the content of this publication would be welcome.


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RICE PRODUCTION, MARKETING AND EXPORT

INTRODUCTION

Rice refers to two species (*Oryza sativa* and *Oryza glaberrima*) of grass, native to tropical and subtropical southeastern Asia and to Africa, which together provide more than one fifth of the calories consumed by humans. Rice is an annual plant, growing to 1-1.8 m tall, occasionally more, with long slender leaves 50–100 cm long and 2–2.5 cm broad. The small wind-pollinated flowers are produced in a branched arching to pendulous inflorescence 30–50 cm long. The seed is a grain (caryopsis) 5–12 mm long and 2–3 mm thick. The word *rice* derives from the Tamil word *arisi*.

Rice is a dietary staple of more than half of the world's human population (most of Asia and Latin America), making it the most consumed cereal grain. Rice cultivation is well suited to countries and regions with low labour costs and high rainfall, as it is very labour-intensive to cultivate and requires plenty of water for irrigation. However, it can be grown practically anywhere, even on steep hillsides. Rice is the world's third largest crop, behind maize (corn) and wheat. Although its species are native to South Asia and certain parts of Africa, centuries of trade and exportation has made it commonplace in many cultures.

Rice is often grown in paddies—shallow puddles take advantage of the rice plant's tolerance to water: the water in the paddies prevents weeds from outgrowing the crop. Once the rice has established dominance of the field, the water can be drained in preparation for harvest. Paddies increase productivity, although rice can also be grown on dry land (including on terraced hillsides) with the help of chemical weed controls.

In some instances, a deepwater strain of rice often called *floating rice* is grown. This can develop elongated stems capable of coping with water depths exceeding 2 meters (6 feet).

Rice paddies are an important habitat for birds such as herons and warblers, and a wide range of amphibians and snakes. They perform a useful function in controlling insect pests by providing useful habitats for those who prey on them.

Whether it is grown in paddies or on dry land, rice requires a great amount of water compared to other food crops. Rice growing is a controversial practice in some areas, particularly in the United States and Australia, where rice farmers use 7% of the nation's

water to generate just 0.02% of GDP. However, in nations that have a periodical rain season and typhoons, rice paddies serve to keep the water supply steady and prevent floods from reaching a dangerous level

Many historians believe that rice was grown as far back as 5000 years B.C. To identify when humans first realised that the rice plant is a source of food and started cultivating it is impossible. The first recorded mention of rice originates in China 2400 B.C. Sheng Nung, the Chinese emperor, realised how important rice was to his people and as a result established annual rice ceremonies. Today the Chinese celebrate rice by the dedication of one of the days in the New Year.

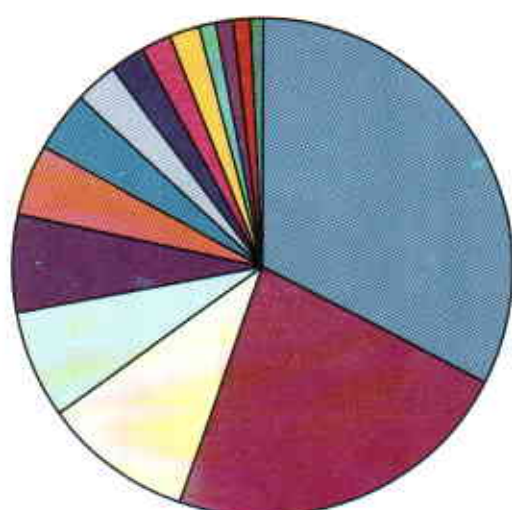
WORLD RICE PRODUCTION

Rice is most important crop in world. There are 119 rice producing countries. China has major contribution to world rice production during 2005-06. She produced 184,254,000 Mt rice which is 30.01 percent of world production. Pakistan's share of world rice production is 1.20 percent and it stands at number 12 with other rice producing countries. The Production of other countries is 422,455,985 Mt, as shown below:

Major Rice Producing Countries

Sr. No.	Country	Production(mt)	% share
1	China	184,254,000	30.01
2	India	129,000,000	21.01
3	Indonesia	53,984,592	8.79
4	Bangladesh	40,054,000	6.52
5	Viet Nam	36,341,000	5.92
6	Thailand	27,000,000	4.40
7	Myanmar	22,000,000	3.58
8	Philippines	14,800,000	2.41
9	Brazil	13,140,900	2.14
10	Japan	10,989,000	1.79
11	United States of America	10,012,190	1.63
12	Pakistan	7,351,000	1.20
13	Korea, Republic of	6,418,000	1.05
14	Egypt	6,200,000	1.01
15	Cambodia	4,200,000	0.68
Sub Total		564,744,682	92.13
Other countries		48,316,303	7.87
Total		614,060,985	100

Source: FAO



- China
- India
- Indonesia
- ▨ Bangladesh
- Viet Nam
- Thailand
- Myanmar
- ▨ Philippines
- Brazil
- Japan

Chart of world Rice production

World Rice Production Trend

The world rice production increased during last five years as shown below

(Million Tonnes)

Year	World	Pakistan	% share
2000-01	598.03	5.82	0.99
2001-02	578.09	6.72	1.06
2002-03	583.02	7.27	1.25
2003-04	606.65	7.53	1.24
2004-05	614.65	7.35	1.2

Source: FAO

World Rice Yield

The world average yield of rice during 2005-06 was 40.51 kg. per acre whereas Pakistan stands at Sr. No. 62 in rice producing countries having average yield of 29.75 kg per acre as shown below;

World Rice Yield during 2005-06

Sr. No.	Country	Yield 40 Kg. Per Acre
1	Egypt	96.50
2	Australia	87.01
3	United Stats of America	74.87
4	Morocco	74.34
5	Greece	73.35
6	Spain	73.14
7	Uruguay	68.50
8	Peru	67.93
9	El Salvador	67.21
10	Turkey	66.39
11	Korea, Republic of	66.26
12	Japan	66.18
13	Argentina	64.14
14	China	63.62
15	Italy	62.43
62	Pakistan	29.75
World Average Yield		40.51

Source: FAO

PRODUCTION OF RICE CROP IN PAKISTAN

Like many other developing countries Pakistan is also land of villages with small holdings subsisting on agriculture. Even rapid industrialization has made no significant dent on agriculture and crop production is major sector of Pakistan's agricultural economy. Among crops, rice (*oryza sativa*) has predominant position. It feeds a considerable portion of our population.

Pakistan has 6.2593 million acre of rice fields producing million tonnes of rice during 2005-06. Area and production of rice increased during last three years. The province wise contribution fluctuated. Punjab stands at top as far as production concerned as shown below;

Province wise Area and Rice Production Trend

Year	Pakistan		Punjab		Sindh		N.W.F.P		Balochistan	
	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
1989-90	5206.4	3220.1	3167.0	1482.2	1619.3	1340.0	152.7	114.6	267.4	283.3
1990-91	5220.4	3260.8	3118.0	1422.3	1680.1	1433.0	153.9	118.0	268.6	287.1
1991-92	5181.6	3243.1	3042.9	1342.2	1711.0	1454.5	155.9	123.0	271.8	290.4
1992-93	4876.5	3116.1	3018.9	1403.9	1405.6	1272.8	153.5	111.9	298.5	327.5
1993-94	5404.5	3994.7	3213.9	1588.2	1736.9	1954.9	154.9	118.4	298.8	333.2
1994-95	5250.1	3446.5	3308.1	1684.0	1478.5	1406.7	156.4	118.2	301.2	237.6
1995-96	5342.0	3933.5	3281.1	1803.0	1587.2	1697.2	157.4	118.2	316.3	348.1
1996-97	5562.7	4304.8	3347.0	1864.0	1734.2	1961.5	159.9	123.5	321.5	355.8
1997-98	5726.3	4333.0	3484.0	1948.0	1703.3	1840.9	165.1	130.2	373.9	413.9
1998-99	5989.0	4673.8	3689.1	2176.0	1739.9	1930.3	168.5	133.6	391.4	433.9
999-200	6215.8	5155.6	3977.0	2481.0	1706.0	2123.0	165.8	129.2	367.0	422.4
2000-01	5872.8	4802.6	4021.0	2577.0	1334.6	1682.3	164.1	131.2	353.1	412.1
2001-02	5224.4	3882.2	3647.1	2266.0	1139.4	1159.1	150.0	121.7	287.9	335.2
2002-03	5498.7	4478.0	3737.0	2579.7	1206.6	1299.7	150.7	131.7	404.3	467.4
2003-04	6080.4	4847.6	4170.9	2871.4	1362.0	1432.8	152.47	130.8	394.88	412.6
2004-05	6182.7	4992.0	4292.3	2949.0	1344.3	1499.0	148.3	123.0	397.8	421.0
2005-06	6259.3	5000.0	4275.0	3000.0	1430.8	1450.0	158.2	135.0	395.4	415.0

Source: Market Committees

Provincial Share in rice Production



EXPORT OF RICE

Rice is an important export item of Pakistan. It is contributing 3.25 percent to the total share of world rice export. World total export is 56,100,707 mt and Pakistan's Portion is 1,822,739 mt. It holds almost monopoly in export of aromatic basmati rice. It fetches three to four times higher prices than other rice varieties of world.

Rice Exporting Countries

Sr. No.	Country	Export-Qty(Mt)	% Share
1	Thailand	9,989,730	17.81
2	India	4,794,539	8.55
3	Viet Nam	4,086,700	7.28
4	United States of America	3,066,765	5.47
5	Pakistan	1,822,739	3.25
6	China	897,100	1.59
7	Egypt	836,941	1.49
8	Italy	668,935	1.19
9	Uruguay	609,169	1.09
10	Spain	346,003	0.62
Sub Total		27,112,651	48.33
Other countries		28,988,056	51.67
Total		56,100,707	100.00

Source: FAO

Recently the government has asked Mexico to send a delegation of experts to Pakistan for talks on rice export resumption. Mexico stopped importing Pakistani rice over a decade ago. Mexico banned rice import from Pakistan after its authorities alleged that Pakistani rice was infected with a kind of virus.

Pakistan is taking the step after 10 years as rice exporters hold the Pakistani authorities responsible for the very long delay in taking up the issue with Mexican authorities. Mexico banned the rice import from Pakistan after its authorities reported that the rice was infected with khupra beetle virus. The move was taken as non-tariff barrier as every country of the WTO are authorized to take such step, which is generally aimed at saving people from diseases, which could spread with virus.



However, the official said that Mexico's fears are based on mere hypothesis. Actually, around 1995, the Mexico government put a number of countries on a list and were denied access to the market under the SPS measure. Sri Lanka, India, Thailand, Pakistan and a number of other countries were put on the list. Pakistan was included in the list without having its rice tested by the Mexican authorities separately. It was a general assumption, the official said. The official said that the ministry of food, agriculture and livestock (MINFAL) has written a letter through proper channel to Mexican authorities to send a delegation of experts to hold meetings with the Pakistani authorities on the issue. They will be informed about the exact situation. No khupra beetle has ever been found in Pakistani rice, the official said. Before the ban, Pakistan's rice export to Mexico amounted to 273 million dollars. Mainly Basmati was exported to that market. The official admitted that it is not money that concerns us. The actual concern is the bad name Pakistani rice is getting in the international market

Rice Importing Countries

Nigeria and Saudi Arabia are major rice importing countries having 1,398,287 and 1,207,265 tonnes import respectively. Other countries have 23343754 tonnes imports during 2005-06.

Rice Importing Countries

Sr. No.	Countries	Quantity(Tonnes)	%Share
1	Nigeria	1,398,287	5.39
2	Saudi Arabia	1,207,265	4.65
3	Philippines	1,049,165	4.04
4	Bangladesh	991,810	3.82
5	Iran, Islamic Rep of	985,998	3.80
6	Chine	928,207	3.58
7	Cote d'Ivoire	868,321	3.35
8	Brazil	852,079	3.28
9	Senegal	822,545	3.17
10	South Africa	744,839	2.87
11	United Arab Emirates	717,710	2.77
12	Korea, Dem People's Rep	702,000	2.71
13	Japan	662,022	2.55
14	United Kingdom	569,560	2.19
15	Malaysia	523,662	2.02
16	United states of America	480,754	1.85
17	Benin	476,488	1.84
18	France	474,266	1.83
19	Mexico	459,207	1.77
20	Russian Federation	454,712	1.75
21	Ghana	448,430	1.73
22	Indonesia	390,832	1.51
23	Singapore	346,702	1.34
24	Canada	334,319	1.29
25	China, Hong Kong SAR	326,226	1.26
26	Yemen	322,241	1.24
27	Cameroon	301,102	1.16
28	Haiti	298,756	1.15
29	Belgium	298,324	1.15
30	Germany	297,618	1.15
Sub Total		18,733,447	72.19
Other Countries		7,215,859	27.81
Total		25,949,306	100

Source:

DOMESTIC MARKETING OF RICE

The government annually reviews the support prices of major varieties of rice paddy. The support prices are designed to provide a floor to the market during the post harvest period when the market price tends to crash. These are meant to correct the shortcomings of the market and not to replace the market price



The government decided to maintain the indicative prices for various varieties of paddy for the 2005-06 crop at their level fixed crop as given below: -

Variety	Rs./40 Kg.
Super Basmati	560
Basmati-385	460
IRRI-6	360
KS-282, DR-82, DR-83 & DR-92 (FAQ)	360

Marketing Channels

Agriculture can be divided into two equal important phases, namely production and marketing. Scientific crop production and organized marketing are the two pillars on which the success of profitable farming hangs. There are various market intermediaries involved in the marketing of paddy – rice. For the purpose of simplification the marketing process can be divided into two parts.

Producer to Processor

- a) Producer → Village Dealer → Commission Agent → Processor.
- b) Producer → Commission Agent → Processor

Processor to Consumer

- a) Processor → Wholesaler → Retailer → Consumer.
- b) Processor → Retailer → Consumer

Marketing Problems

- a) At the time of harvest, the price of paddy goes down and in the absence of any Govt. procuring agency it goes even below the support price. Being small in size, farmer's are bound of sell their produce to meet their financial needs. Once the crop is out of the hands of producers, the price starts stabilizing. In this manner, the benefit neither goes to the producer nor to the consumer.
- b) Illegal deduction in the name of moisture is made from the producer and other malpractices like chung etc. are also made by the commission agent.
- c) Less holding and storage capacity force the producer to bring their produce to the market which creates glut in the market and price goes down.
- d) Much delayed payments to the producer by the commission agent or other buyers of the produce.

PROBLEMS OF RICE EXPORTERS AS SEEN BY REAP

- a) Export of rice is declining due to absence of long-term policy.
- b) The SBP governor had given assurance that rice exporters would have the facility of export refinancing in the US dollar but no such facility was being provided by any bank on the pretext that they had not yet received any circular or directive from the State Bank.
- c) The Reap members emphasized on the need that government should announce long-term policy so that Pakistani exporters could survive in the tough competition particularly with India, which is facilitating its exporters by giving them heavy subsidy.
- d) The members said in order to promote rice exports the withholding tax may be fixed at 0.75 per cent instead of 1.25 per cent. They said that the war risk surcharge was uncalled for as the ports of Pakistan are functioning in routine.

- e) The Reap members also said that they were not getting their due share from EDF due to which their programme of sending delegations to foreign countries and R and D were not being materialized.

PROPOSED MEASURES TO IMPROVE PRODUCTIVITY AND MARKETING

Improved Seed

To enhance the production and distribution of certified seed of rice, the Government should arrange to: -

- a) Increase the supply of pre-basic seed by providing additional facilities to the research stations and to allow the private seed companies to produce pre-basic seed to meet their own requirements.
- b) Increase credit facilities to seed companies.
- c) Provide relief in term of taxes (custom, import duties, income and local taxes) to the seed companies;
- d) Check the marketing of seed of unknown quality by un-registered seed companies.

Mechanical Transplanting

To facilitate the introduction and adoption of mechanical transplanter by growers so as to increase plant population in rice field, it is suggested that farmers be trained in raising nursery in plastic tray to facilitate machine transplanting of seedlings.



Soil Management – Use of Gypsum

To encourage the use of gypsum for ameliorating the condition of the marginal lands and blackish tube well water: -

- a) Growers be educated about the importance of the use of gypsum by launching promotional campaigns.

- b) To reduce the cost of gypsum, incentives in the form of rebates in taxes be provided to the gypsum suppliers.

Use of Zinc Sulfate

- a) Extension Wing of Agriculture Department should educate the growers about the benefits of the use of Zinc Sulfate in rice cultivation;
- b) Public sector fertilizer distributing agencies be asked to arrange the supply of Zinc Sulfate and propagate its use through aggressive marketing.

Harvesting and Threshing of Rice

Reportedly, harvesting and threshing losses are as high as 15 to 20% with conventional method of harvesting (manual using sickles) and threshing through beating. To check the deterioration of quality and harvesting losses due to poor threshing practices, it is suggested that:



- a) The growers be educated for the use of head feeding combines or resorting to manual threshing of the crop immediately after harvest.
- b) Incentives be provided to private sector for importing already tested Head Feeding Combines, developed in Japan for supplying to growers on custom hire rates.
- c) Feasibility of importing re-conditioned combines be studied and their import allowed, if cost effective.

Storage

Storage losses in case of paddy food grains in Pakistan is estimated to be about 7 percent. There are six types of organisms associated with storage which can cause losses which are bacteria, fungi, mites, insects, birds and rodents. The activity of these organisms depends on the temperature and moisture content of seed and relative humidity of the environment.

Measures to be taken before storage

- a) Clean all storage areas before use. All storage structures should be cleaned and sprayed with an insecticide (e.g., Malathion, 1 part in 25 parts of water at a rate of 5 litres/100 m²).
- b) Fumigate raw seeds at reception, in particular seed of pulses where insect infestation (bruchids) comes from the field.
- c) Processed seed should be kept separate from unprocessed or carry-over seed.

Measures to be taken during storage

- a) Store cleaned and non-cleaned seed separately.
- b) Store different types of seeds, in particular, pulses and cereals well apart for better insect management.
- c) Check and monitor seed conditions regularly.
- d) Inspect the incoming seed for insects.
- e) Inspect stored seed at regular intervals for fungi, insects, rodents, and birds. Insects that grow inside the seed are often not seen until after they have caused damage.
- f) Test seed for germination and viability (germination test, Tetrazolium test, accelerated aging test).
- g) Keep the storage areas clean at all time.

Weed Control

Agricultural research institutes should undertake the testing of all available weedicides and publicize the use of those weedicides that have minimum impact on growth and other characteristics of rice plant.



Power duster



Power duster

Integrated Pest Management

To minimize the use of chemicals, efforts should be made to encourage growers to adopt following cultural, mechanical and biological measures: -

- a) Avoiding the cultivation of varieties susceptible to various pests and diseases of area.
- b) Selection of varieties resistant to one or more prominent pest of area.
- c) Adhering to the recommended time of sowing of nurseries and transplanting of seedlings, disposal of rice straw to distant place after harvest, rotavating of rice stubbles and keeping 'watts' and 'bunds' of field free of grasses during spring;
- d) The chemical control of pests, if needed, should be preferred through the use of granular pesticides to the extent feasible as their application does not kill predators of rice pests;
- e) The infested leaves containing larvae of leaf roller be destroyed; and
- f) Extracts of some plants (like Nimbokil extracted from Neem) are effective in the control of sucking pests, leaf roller; and rice borers and also does not kill predators be used in the pest control.

Implementation of Support Price

- a) Early announcement of support price by the government should be ensured.
- b) Procurement agency should be assigned the paddy procurement on permanent footings which should make all arrangements regarding storage, milling etc.
- c) Procurement specifications need to be reviewed because harvesting/threshing practices have changed over time. For this purpose, an expert committee may be constituted which should include in addition to rice experts, the growers and millers also.
- d) Supervisory committees at thesil level should check the paddy procurement operations. These committees should have official from the District Government, Agriculture Department and representative of growers.
- e) Support price of cleaned rice duly protecting the prices of paddy fixed by the government should also be announced and implemented.

Improving quality for marketing

Quality of paddy is adversely effected if the moisture level during storage is too high. In order to objectively determine the quality of paddy, use of moisture meters and paddy de-husker should be made compulsory by all the dealers and millers purchasing paddy.



Moisture Meter



Paddy de-husker

- a) Import of modern machinery for processing/polishing etc. should be duty free. Tax holidays should also be given for establishing such industry.
- b) Institutional credit for the balancing and modernization of rice mills i.e. for installing paddy separators, cleaners, de-stones and polihers etc. be made available.
- c) Strict quality control be exercised at various stages of processing and marketing to improve the quality of the product.
- d) Prices of cleaned rice for export needs to be based on the standards fixed by PSI and enforced by the concerned agencies.
- e) The government should allow the import of lightweight reapers/combine harvesters from Japan, Korea. Then proto-type manufacturing of such machines within the country should also be facilitated.
- f) The government should exercise strict quality check on the rice exports and each export consignment should have the label indicating its specifications along with an essentially approved trademark. A quality certificate must accompany export consignment from the authorized agency.
- g) Pakistan embassies should be asked to inquire into and inform the government about marketing techniques adopted by our competitors, which are defaming Pakistani basmati in the international markets so that corrective steps may be taken.

SUPPORT/INDICATIVE PRICE OF PADDY

Government announces indicative price of crops to improve the condition of growers. The supper basmati support price ranged from 460 to 560 during last five years. Data shows rising trend of indicative price of paddy for all varieties in Pakistan.

Support / Indicative Price of Paddy Variety wise

Year	Variety	Support Price
2001-02	Supper Basmati	460
	Basmati	385
	IRRI-6	205
	KS-282, DR-82, 83 & 92 (FAQ)	220
		Indicative Price
2002-03	Supper Basmati	460
	Basmati	385
	IRRI-6	205
	KS-282, DR-82, 83 & 92 (FAQ)	220
2003-04	Supper Basmati	485
	Basmati	400
	IRRI-6	215
	KS-282, DR-82, 83 & 92 (FAQ)	230
2004-05	Supper Basmati	510
	Basmati	415
	IRRI & OTHERS	230
2005-06	Supper Basmati	560
	Basmati	460
	IRRI-OTHERS	260

Source: Agriculture Statistics

Rice Price in Main Market of Punjab 2005-06

The price of Basmati-385, and IRRI-6 prevailing in the major producing area of Punjab during harvest period of 2005-06 crop as indicated below;

District/ Division	Oct	Nov	Dec	Average	Support Price
Supper Basmati					
Gujranwala	495	520	560	525	560
Sialkot	490	532	572	531	560
Sheikhpura	495	507	560	520	560
Hafizabad	494	535	565	531	560
Basmati 85					
Gujranwala	420	425	-	422	460
Sialkot	437	440	440	439	460
Sheikhpura	400	410	-	405	460
Hafizabad	425	415	-	420	460
IRRI-6					
Kasur	260	267	285	271	260
Okara	270	285	287	281	260

Source: Market Committees

RICE VARIETIES

Jasmine Rice of Thailand

It grows well in drought conditions and on saline soils, so it suits the farming conditions of north-east Thailand. By contrast, the IRRI's varieties are made to suit high-input chemical agriculture in irrigated lands, which poor people cannot afford.

Virtually all Thai Jasmine rice is produced by five million farmers in the Isan areas in the north-east. These are resource-poor farmers, whose monthly income does not exceed the poverty line of \$200 per capita. Their livelihoods depend on Jasmine.

RiceTec's Jasmati is derived from a variety called Della, developed in the U.S. Della is a selection from Bertone, which is from the Piedmont area of Italy.

Basmati

Basmati is a variety of long grain rice, famous for its fragrance and delicate flavour. Its name means "Queen of Fragrance" in Hindi. Basmati rice has been cultivated in India and Pakistan for hundreds of years, and some varieties are now grown in the United States. The Himalayan foothills are said to produce the best basmati and Dehra Dun is the most prized of these varieties. Patna rice is a close cousin of basmati rice grown around Patna in Bihar. The best types of basmati rice are aged for several years before they are milled and sold.

The grains of basmati rice are much longer than they are wide, and they grow even longer as they cook. They stay firm and separate, not sticky, after cooking. Basmati rice is available both as a white rice and a brown rice. Both of these cook in about 20 minutes. Due to the high amount of starch clinging to the rice grains, many cooks wash this rice before cooking it. Soaking it for half an hour to two hours before cooking makes the grains less likely to break in cooking.

A number of varieties of Basmati rice exist. Traditional ones include Basmati-370 and Basmati-Ranabirpura, while hybrid basmati varieties include Pusa Basanti 1 (also called 'Todal', because the flower has awns). Fragrant rices that are derived from basmati stock but are not considered true basmati varieties include PB2 (also called sugandh-2), PB3 and RH-10. Traditional basmati plants are tall and slender and are prone to lodging in high winds. They have a relatively low yield, but produce high-quality grains and command high prices in both Indian and international markets.

Black Rice

Black rice is one of several black-colored heirloom plants producing rice variants such as Indonesian Black Rice, forbidden rice, or wild rice. High in nutritional and medicinal value, forbidden rice is rich in iron and considered a blood tonifier. Unlike other black rice from Asia, it is not glutinous or rough. This grain is high in fiber and has a deep, nutty taste. The deep color of black forbidden rice suggests the presence of phytonutrients. It has a relatively high mineral content (including iron) and, like most rice, supplies several important amino acids.

POST HARVEST LOSSES OF RICE

The early HYV varieties shattered easily, and had short dormancy periods. Delays in harvesting caused significant losses. A crop harvested wet has to be immediately threshed and dried, or else it will germinate, discolor, or even rot. Field stacking of wet harvested rice makes the kernels turn yellow. In some countries, physical losses in the field from harvesting are almost nil. In Bangladesh, for example, gleaners will pick up every grain left in the field after harvesting. In the Philippines, ducks are let loose in the field to feed on grain left in the field.

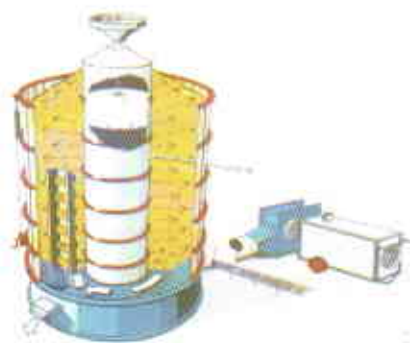
In general, manual harvesting has lower loss levels than mechanized harvesting. However, if manual harvesting is delayed due to a lack of labor, then losses will be incurred due to shattering of overripe grain. Threshing by trampling or beating does not cause losses. However, as farm labor becomes scarce, reaping and threshing machines, or combines must be used. There is a trade-off between the need to mechanize and the higher level of losses with machines. The inability of farmers to harvest, thresh, and dry grain was the primary cause of huge field losses during the early days of the Green Revolution. Today, the main cause of losses is the inefficient equipment used in the post-production system.

Losses in Drying Paddy

The traditional method of drying the harvested rice crop is by drying it in the sun. The crop is either left in windrows in the field to dry after reaping but before threshing, or spread out on mats or pavements after threshing. During the wet season, if there is no "artificial" drying capacity, it is not uncommon for the grain to sprout and rot before it

can be dried. If there is any delay in drying, the wet grain becomes darker in color. Farmers are thus led to believe that the summer crop that can be sun-dried straight after harvesting has a whiter and brighter luster.

There has been a preoccupation in developing artificial or mechanical drying machines to cope with the new varieties. Nowadays, most losses in drying occur because of either



poor technical performance of the technology, or improper use of the technology, resulting in fissured grain. Fissured grain results in significantly lower milling recoveries.

The rice drying process has been thoroughly studied. It has been established that thermal stresses, high rates of moisture desorption, or moisture reabsorption by dried grains, all cause the rice kernel to fissure. The typical HYV medium-to long-grain Indica variety has 20% hull (or husk), and 10% bran layers. The theoretical milling yield of polished grain should therefore be 70%. State-of-the-art commercial mills, properly adjusted and working with good quality paddy, can yield 67% milled rice, with head rice (3/4 to whole grains) above 70%. Poor quality paddy that is badly fissured can lower total milling yields to as low as 60%. Much of the grain endosperm is reduced to rice flour that goes with the bran, or to brewers' rice that is separated from the commercial milled rice output by sifters. The bran and rice flour, and small broken grains, are used as animal feed. Unfortunately the basic principles of proper drying are not yet widely known in the industry.

Losses in Paddy Milling

Similarly, losses in the milling process are due either to inherent poor technical performance of milling machinery, or operator ineptitude, resulting in poor milling yields.



Rice milling



Gravity separator



Colour sorter



Rice Sorted By Colour Sorted

The most significant breakthrough in the rice milling industry has been the development of the husking machines with rubber rollers, which significantly reduce grain breakage. Modern milling plants now have 10 distinct steps in the process. Some setups are automated to reduce dependence on unskilled operators. The challenge is to bring this technological development within the reach of small entrepreneurs in Asia.

Losses of Rice within the Post Harvest System

Country	Total Weight Loss (%)	Remarks
Bangladesh	7	
India	6	Unspecified storage
	3-3.5	Improved traditional storage
Indonesia	6-17	Drying 2, storage 2 - 5%
Malaysia	17-25	Central storage 6, threshing 5-13% Drying 2, on-farm storage 5, handling 6%
Nepal	4-22	On-farm 3-4, on-farm storage 15%, central storage 1-3%
Pakistan	7	Unspecified storage 5%
	2-6	Unspecified storage 2%
	5-10	Unspecified storage 5-10%
Philippines	9-34	Drying 1-5, unspecified storage 2-6, threshing 2-6%
	Upto 30	Handling
	3-10	
Sri Lanka	13.40	Drying 1-5, central storage 6.5, threshing 2- 6%
		Drying 1-3, on-farm storage 2-6, milling 2

Source: FAO

RICE PRODUCTS

The seeds of the rice plant are first milled to remove the outer husks of the grain; this creates brown rice. This process may be continued, removing the germ and the rest of the husk, called bran at this point, creating white rice. The white rice may then be buffed with glucose or talc powder (often called *polished rice*), parboiled, or processed into flour. The white rice may also be enriched to add nutrients, especially those lost during the milling process. While the cheapest method of enriching involves adding a powdered blend of nutrients that will easily wash off, more sophisticated methods apply nutrients directly to the grain, coating the grain with a water insoluble substance which is resistant to washing. While washing is counterproductive for the powder enriched rice,

it is absolutely necessary to create a better tasting and better consistency of rice when polished rice is used.

Rice bran, called *nuka* in Japan, is a valuable commodity in Asia and is used for many daily needs. It is a moist inner oily layer that is heated to produce a very healthy oil. Another use is to make a kind of pickled vegetable. The raw rice may be ground into flour for many uses as well, including making many kinds of beverages such as amazake, horchata, rice milk, and sake. Rice flour is generally safe for people on a gluten-free diet. Rice may also be made into various types of noodles. The processed rice seeds are usually boiled or steamed to make them edible, after which they may be fried in oil, or butter, or beaten in a tub to make mochi. Rice, like other cereal grains, can be *puffed* (or *popped*). This process takes advantage of the grains' moisture content and typically involves heating grain pellets in a special chamber. Further puffing is sometimes accomplished by processing pre-puffed pellets in a low-pressure chamber. By the ideal gas law, one can see that both lowering the local pressure or raising the moisture temperature would result in an increase in volume prior to moisture evaporation, thus resulting in a puffy texture.

Rice Vinegar

Rice vinegar is a byproduct of SAKE (Japanese rice wine) and is used heavily with sushi in Japan. About two decades ago, rice vinegar was introduced in the U.S.A. Seasoned Rice Vinegar is rice vinegar blended with sweeteners and salts. Rice vinegars are popular because they are sweeter, milder, and less acidic than traditional white vinegar. The manufacturing process starts with the finest real, whole grain rice. The rice goes through a double fermentation process, after which it is filtered, refined, pasteurized, and purified. The end result is rice vinegar. Sweeteners, salts, and other flavorings are blended into rice vinegar to create Seasoned Rice Vinegar.

Both are lightly flavored with sugar and salt for a smooth, mellow flavor. The flavored Seasoned Rice Vinegars have been infused with a special blend of seasonings that may include Italian herbs, red pepper, roasted garlic, or basil and oregano. All are great for splashing on your favorite food as a flavor enhancer or as a versatile recipe ingredient. Seasoned Rice Vinegar is so versatile that it can be used in almost any recipes. Used

straight on salad, mix it with oil to make a salad dressing, use it for marinade, or splash on any grilled meats or vegetables, just to name a few.

Rice Protein Powder

Hypo-allergenic vegetable protein made from non-GMO California grown brown rice. Free of the common food allergens normally associated with these products such as soy, milk, egg, wheat, yeast, sugar, or preservatives. This highly soluble powdered formula mixes easily into water, juice or sprinkled on cereals, yogurts, or added to cooked dishes (not to be heated above 120 degrees F) for an extra protein boost without adding fat or a lot of calories. It has been also used for tube feedings of infants, the elderly, & the severely ill. Chemical processing is avoided by using a purified water & natural enzyme procedure. Rice protein is utilized more efficiently by the body than soy. It has a mild flavor similar to that of Cream of Rice. At about 58 calories per tablespoon (or 15 gram serving), rice protein is one of the lightest protein sources around. Made in a Dedicated Plant with no Wheat, Gluten, Peanuts, Tree Nuts, Egg, Soy, Corn, Potato, Sugar, Yeast. Shared lines with Dairy but processed on separate day after extensive cleaning.

Rice Starch

Indeed rice starch - with its tiny granule size, neutral taste, and soft mouth-feel - can now be found in a wide range of foodstuffs, for example ice cream and yoghurt. It is also used as an alternative to fat in reduced-fat foods and a thickener in soups and sauces. As a result, many global food manufacturers have already voluntarily agreed to reduce the level of ingredients such as saturated fats across their product lines. Global food giant Kraft, for instance, has already introduced a universal Sensible Solution healthy labeling policy, which alerts consumers about some of its healthier, more nutritious products and has also pledged to review and remove products that fail to meet dietary standards.

This trend has heightened the marketability of rice starch. However a cost-effective and environmentally friendly process for accessing rice starch, by breaking down milled rice into its starch and protein fractions, has been elusive. The processes used to separate and extract bound-up rice fractions can alter the nutritional qualities of starch and protein, and for nearly 60 years, the processing of this starch has relied on the action of a corrosive alkali, sodium hydroxide, to slowly dissolve rice protein and release the starch. Long-, medium-, and short-grain rices contain varying ratios of the two starch components, amylose and amylopectin. Amylopectin is found in highest concentrations

in short-grain, also called sticky or waxy rice. Amylose is highest in long-grain rice—enabling these grains to be separate and fluffy when cooked. Rice protein is also valued for its easy digestibility. Baby foods and formula and special dietary goods rely on a steady stream of this protein, since some children and adults are sensitive to the proteins in other grains.

Rice Cake

Rice cakes have literally exploded in popularity as a low calorie, low fat snack. Rice cakes have only two critical ingredients—rice and water. The rice itself needs certain characteristics to produce the best quality cake and limit breakage. Sticky rice, whether white or brown, tends to work best, while long-grain varieties don't expand during cooking as vigorously. Water is important early in preparation. Other ingredients like salt (added before popping or sprayed on after) and various flavorings are important considerations to taste- and nutrition-conscious consumers but are not significant to the production process.

The simple process of making rice cakes is based on the fact that rice subjected to the right combination of heat and pressure. The rice cakes are sprayed and packaged. The manufacturer's specifically preferred type of raw rice (depending on stickiness, expansion potential, and taste) is soaked in water until the right moisture level is attained. The moist rice is fed into hoppers above popping machines. A major producer of rice cakes may have 80 or 90 machines with one to three cooking heads, each of which produces one cake every 15 seconds. The rice is gravity-fed from the hopper into the cast-iron mold or cooking head in the popping machine. The mold is heated to hundreds of degrees, and a slide plate opens to impose a vacuum on the moist rice mass. After 8 to 10 seconds of exposure to heat at this pressure, the lid of the mold expands, creating an even greater vacuum on the contents. In the last few seconds of heating, the mixture explodes to fill the given space. If the rice forms a large proportion of the exploded mass, it will be more satisfying, have a better texture, and be full of natural flavor. After the cake has exploded in the popping machine, the cooking head opens and the cake falls gently on a conveyor belt. The conveyor, now carrying flavored cakes, passes through a tunnel dryer where the moisture added by the flavor sprayers is driven off. The conveyor moves to the bagging area, where the rice cakes are removed from the conveyor by hand, inspected for any breakage, and stacked, sealed in shrink wrap, and packaged in an over-wrap bag printed with the product identification and sealed. The bags are then packed in cartons for bulk sale.

New Kinds of Parboiled Rice

At present, standard rice is parboiled with the grain hull. This process has an effect on the rice flavour that is slightly modified by the hull (bran). The technology permits to husk the rice before to be cooked with minor damage (broken rice grains). Then flavour problem is solved (less taste and smell bran is obtained). A wide range of different kinds of parboiled rice can be manufactured. Parboiled rice made from cargo rice. Traditionally parboiled rice has always been made from rough rice. Parboiled rice are manufactured by using cargo rice (no grain hull).

8-Minute parboiled rice: The developed technology permits to produce parboiled rice that cooks in 8 minutes. The grain looks the same as clear parboiled rice and has the same nutritional qualities.

Manufacturing of Cookie using Processed Brown Rice

Brown rice has better nutrition value and health benefits than polished rice does, including vitamins and dietary fibers. The whole grains of brown rice were processed by steeping, steaming, drying, and roasting to increase its taste, mouthfeel, and palatability. The processed brown rice has roasted flavor and crunchiness in texture. Proximate composition of processed brown rice and cookies were analyzed by AOAC method. Processed brown rice was added to wheat flour from 10% to 50% (w/w) to make dough for cookies and texture of the dough was measured by a TA-XT2 Texture Analyzer.

WTO RELATED ISSUE

Aflatoxin Problem in Brown Rice

Unlike other cereals, rice crop is harvested when the grain is fairly moist. For optimum milling yield and good cooking quality, the moisture content in the paddy grain at the time of harvest must be between 20-22% (wet basis). Secondly, the harvesting season of Basmati rice in Punjab is mid-November depending on agro-ecological zones. During the months of October and November the ambient temperature is relatively low and relative humidity (RH) is fairly high. Both these natural conditions hamper the quick and efficient drying of the freshly harvest paddy. The post-harvest handling of paddy becomes still more problematic if winter rain showers set in a little early in the season. Thirdly, the shortage and high cost of farm labour has forced the rice grower to adopt

mechanical harvesting system. The combine harvester machines available to the growers are designed basically for harvesting wheat crop and do not give good results with rice crop. Immature paddy grains alongwith green leaves and trash are simultaneously stripped off and mixed with the grains raising the moisture level of the produce. To overcome these problems and to ensure good quality milled rice, it is necessary to dry the threshed paddy to 13-14% moisture level without delay to avoid the development of Aflatoxin.

The basic cause of Aflatoxin development in brown rice is the growth of fungi particularly *Aspergillus Flovus*. Improper post harvest handling, leading to high moisture in paddy and grain, favours the growth of fungi. When fungus is allowed to grow on grain, it produces a toxin called Aflatoxin. Studies have revealed that this mould produces several related compounds known as Aflatoxin B₁, B₂, G₁, G₂. The most toxic is Aflatoxin B₁ that has lethal dose (LD 50) of 18 µg/kg. The maximum permissible limit by FAO/WHO in human being is 20 ppb (Parts per Billion) or 20 µg/kg. If consumed in low levels it results in slower than normal growth rate. In larger amounts, it may cause various lesions, especially in the liver and consumed in still in larger amount it may cause death. Optimum conditions that favour the development of storage fungi are: relative humidity (RH%) above 85%, moisture in the grain above 18% and temperature between 26-30°C. The presence of Aflatoxin in rice is undesirable under the WTO's requirements for export.

Sustainable export of rice from Pakistan, particularly of brown rice, demands that the growers, dealers and particularly the millers/exports all must be educated on the importance of proper post harvest handling of paddy that includes immediate drying of fresh paddy and storage in dry, well ventilated ware house. To this end the Agriculture Marketing Department has mobilized the Market Committees through provision of moisture meter to ensure that the freshly harvested paddy reaching the grain markets for sale must meet some minimum standards of purity and moisture content. By offering paddy price on the basis of grain quality analysis report, the growers may be encouraged to harvest their crop at the optimum stage of maturity (Moisture content between 20-22%). Once the paddy is dried to a moisture content of 13-14% immediately after harvest, normal weather conditions in the Punjab are not such that can contribute to the development of Aflatoxin in paddy/brown rice. It must be ensured that each and every lot of brown rice meant for export must be checked and cleared before shipment. Government of Pakistan has recently signed a Memorandum of Understanding (MOU) with China to export rice. A copy of the MOU is attached as **Annexure-I**.

Annexure-I

MEMORANDUM OF UNDERSTANDING (MOU)
SANITARY AND PHYTOSANITARY REQUIREMENTS FOR EXPORT OF RICE
FROM PAKISTAN TO CHINA

In order to ensure the safe entry of Pakistan rice into China, prevent the introduction of pests and guarantee the health of animal and plant, based on the Pest Risk Analysis results and the principles of Agreement on the Application of Sanitary and Phytosanitary Measures of WTO (SPS Agreement), the Ministry of Food, Agriculture and Livestock of the Islamic Republic of Pakistan (hereinafter referred to as MINFAL) and the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (hereinafter referred to as AQSIQ), through friendly consultations, have reached the following consensus with regards to the Phytosanitary requirements for exports of rice from Pakistan to China:

Article-1

The Pakistan rice exported to China "the rice" shall comply with the Chinese plant quarantine laws and regulations.

Article-2

The MINFAL shall enforce the requirements of this protocol in the inspection of the rice and certify that the rice exported to China is free from the following quarantine pests of China's concern: *Trogoderma granarium*, , *Alternaria padwickii*, *Ditylenchus engustus* and *Striga asiatica*. Each batch of the rice passing the inspection will be issued an official phytosanitary certificate demonstrating that it has fulfilled the Chinese phytosanitary requirements and specifying the origin of production.

Article-3

The Pest Free Area (the area) of above quarantine pests shall be established by the MINFAL according to the international standards of International plant Protection Convention (IPPC) concerned, and be confirmed by AQSIQ.

Article-4

During the rice growing season and storage period, the MINFAL shall survey and control the pests in the area, especially those quarantine pests of China's concern. The MINFAL has the responsibility to provide AQSIQ with survey methods and test results regularly. If a new pest occurs on rice in Pakistan, MINFAL shall inform AQSIQ in time.

Article-5

The rice shall be free of soil as well as seeds of weeds, paddy hull, bran and any of plant debris of rice.

Article-6

Packaging materials of the rice shall meet the requirements of Chinese plant quarantine, be clean and new. Each carton of the rice shall have the markings to indicate the rice variety, the name and place of processing unit, packing-house, storage-house and exporter.

Article-7

The rice shall be fumigated to ensure its freedom of any live insects, especially storage pests, and an official Fumigation Certificate shall be issued by the MINFAL. Treatment chemicals and methods shall be co-confirmed by the MINFAL and the AQSIQ. Before shipment, the container shall be inspected and disinfected thoroughly to prevent introduction of any quarantine pests into the rice.

Article-8

When the rice reaches the entry ports in China, the AQSIQ subordinate, Chinese Inspection and Quarantine (CIQ), will conduct a quarantine inspection.

Article-9

According to the information provided by the MINFAL and status of interception by the CIQ the AQSIQ will re-PRA, if considered necessary.

Article-10

The AQSIQ will inform the MINFAL of quarantine problems in the rice and the phytosanitary measures taken, in accordance with the principle of the international standards of International Plant Protection Convention. Both sides shall resolve the quarantine problems through friendly consultation, on the basis of guaranteed safety and the promotion of trade.

Article-11

Both sides will promote and enhance the cooperation between the phytosanitary experts of two countries, exchange technical information on rice inspection and quarantine.

Article-12

The AQSIQ will send 3-4 inspectors to Pakistan to conduct a 15 days pest survey and pre-clearance inspection at the production area in the first year of trade, which is the trial year of trade. Subsequent visits will be paid if quarantine pests are intercepted. All expenses (including transportation, per-diem and miscellaneous expenses) will be paid by Pakistan exporters MINFAL shall issue an invitation and assist the travel arrangements.

Article-13

Both sides agree that the provisions of this protocol shall not be in conflict with the laws and regulations of the two countries and shall implemented in conformity with laws and regulations.

Article-14

All disputes between the AQSIQ and MINFAL concerning the interpretation and application of this protocol shall be settled amicably through mutual consultation between them.

Article-15

This protocol may be amended or modified through mutual written agreement.

Article-16

This protocol will enter into force on the date of signing and will remain valid for two years from the date of entry into force. It will be extended automatically for periods of two years unless terminated. Either side may terminate this protocol at any time, by giving a notice of three months to the other party. All actions taken during the validity of this protocols shall continue to be governed by its provisions till their completion.

The Protocol is signed in duplicate at Islamabad on April 5, 2005.

Agricultural Marketing Government of the Punjab

INTRODUCTION

The Agricultural Produce Markets Act, 1939 was promulgated on the recommendation of Royal Commission constituted by the British India Government during 1927. The sole-intention of the act was to regulate the Agri. Business so as to do away the evils and vices which ultimately tended to the deprivation of the grower from his fair return of his produce. The market committees were established under the provisions of above said act which were assigned noble pursuit i.e. Safeguard the interest of grower.

The Act of 1939 was replaced by the Punjab Local Government Act, 1975, but for legal and technical reasons, the provisions of the act could not be enforced. Later, the relevant provisions of the Punjab Local Government Act, 1975 were replaced by the Punjab Agricultural Produce Markets Ordinance (PAPMO), 1978 and rules were framed during 1979.

VISION OF AGRICULTURAL MARKETING:

To increase profitability of the growers through modern marketing infrastructure, competitive marketing environment and entrepreneurial capacity building

FUNCTION:

- Managing 325 Agricultural Markets in Punjab including Grain, Fruit & Vegetable and Feeder Markets
- Supervision of 133 Market Committees in Punjab
- Establishment of New Markets
- Collection and dissemination of marketing information
- Release of Daily Price Bulletin through Electronic & other Media
- Economics of Crop and Price analysis report on various Crops
- Survey and studies
- Monthly Price and Corps situation report on various Crops
- Supervision of Sunday/Friday Bazaars
- Supervision of Ramzan/Sasta Bazaars

MARKET COMMITTEES IN PUNJAB

Market committees is a corporate body established under section 7 of the PAPMO, 1978, Exercising control on sale/purchase of Agricultural produce in its area notified under section 4 of the said Ordinance

DUTIES OF MARKET COMMITTEES

To enforce the Provisions of Ordinance and Rules

To Establish Agricultural Produce Markets

Collection and dissemination of prices of agricultural produce

Coordination with District Administration for organizing Sunday/Friday Bazaars/Ramzan/Sasta

INITIATIVES FOR IMPROVEMENT OF AGRICULTURAL MARKETING

A separate ministry of agricultural marketing has been created

A CORPORATE BODY "Punjab AgriMarketing Company" (PAMCO) has been established for improvement of agricultural marketing with private sector

Participation

Agricultural Marketing Information System (MIS) has been established, Website www.punjabagmarket.info has been launched

Toll free No.0800-51111 has been installed

Establishing the markets under private sector allowed for healthy competition with public sector

Existing Agricultural Produce Markets Laws are being revamped

A Task Force has been constituted to guide formulation of policies for improvement of Agricultural Marketing

Creating awareness and compliance of WTO agreement

Infrastructure in existing 30 markets in being upgraded

Cold chain is being established to maintain quality of exportable perishable commodities in producing area under PAMCO

Training programme for growers, commission agents and other dealing in agricultural produce especially fruit & Vegetable being arranged

Importers and potential investors from other countries are being encouraged to boost export and enhance investment

Workshops, seminars, conferences to create awareness about the Agricultural Marketing System

Agreement/protocols and MOUs on Phytosanitary Requirements for Export of Rice, Citrus and Mango have been signed between MINFAL and AQSIQ.