GOVERNMENT OF SINDH
AGRICULTURE DEPARTMENT
PC-I
(SOCIAL SECTORS)
AGRICULTURE RESEARCH

PC – I

ON

DEVELOPMENT & PROPAGATION OF POST HARVEST TECHNOLOGY TO INCREASE SHELF LIFE OF FRUIT & VEGETABLES

DIRECTORATE GENERAL
AGRICULTURE RESEARCH SINDH
TANDOJAM

GOVERNMENT OF SINDH
PLANNING & DEVELOPMENT DEPARTMENT
PC-I
(SOCIAL SECTORS)
AGRICULTURE RESEARCH

1.	Name of Project:	Development & Propagation of Post Harvest Technology to increase shelf life of fruit & vegetables.
2.	Location	a) SHRI Mirpurkhas, Model Farm at Mirpurkhas & Tando Allahyar and Kunri District Umerkot. b) Agriculture Research Institute, Tandojam
3.	Authorities responsible for	
	I) Sponsoring	Secretary, Agriculture Department, Government of Sindh.
	II) Execution	Director General, Agriculture Research Sindh, Tandojam.
	III) Operation Maintenance	1. Director General Agriculture Research Sindh, Tandojam 2. Director Sindh Horticulture Research Institute, Mirpurkhas 3. Postharvest Technologist Sindh Horticulture Research Institute, Mirpurkhas
4.	a) Plan Provision	
	i. If the project is included in the medium term/five years plan specify actual allocation.	Not included

	ii. If not included in the current plan, what warrants its inclusion and how is it now proposed to be accommodated.	The project will be funded through ADP in the year 2008-09
	iii. If the project is proposed to be financed out of block provision indicate	Not applicable

a) Total Block Provision	Amount already committed (Agri. Deptt).	Amount proposed for the project.	Balance available
---	---	**Rs: 31.331 million**	---

	b) Provision in the current year PSDP / ADP	**Rs. 5.333 million**
5.	Project Objectives:	
	A):	1) Conduct research to minimize postharvest losses in mango, banana, dates, onion & chilies. 2) Determine ways and means to enhance the quality of fruits and vegetables. 3) Monitor fruit fly infestation in mango, guava and ber. 4) Control of anthracnose disease of mango. 5) Develop and disseminate appropriate technology regarding onion storage. 6) Organize field days and seminars

i)	The objectives of the Sector / sub sector as indicate in the medium term/five years plan be reproduced. Indicate objectives of the project and sectoral objectives.	The above objective clearly support and supplement the objective of agriculture sector that aim at achieving of agriculture through improved technology, improved product quality, international standards compliance, reduce the post harvest losses, quality control and labeling enhance the farmers income and generate the employment opportunities. The experts and policy maker's view that the increase of income, welfare and decrease in rural poverty is possible through reduction of post harvest losses, which would be achieved through the present project. Moreover, enhanced fruit and vegetable exports would result into higher income to the fruit and vegetable growers, traders etc. the saving of losses achieved through this project will lead to sustainable growth of agriculture sector and full exploitation of the potential factors. This is in line with the basic aim and objective of agriculture sector. The present project is in line with the main objectives of development strategy of Sindh Government. The project activities will increase the income of the farmers though reduction of losses and will promote growth in the agriculture sector.

6.	Description & Justification of the project

Technical Parameter

Horticultural crops not only provide human beings with nutritional and healthy foods, but also generate a considerable cash income for growers in Sindh. However, horticultural crops typically have a high moisture content, tender texture, and high perish ability. If not handled properly, a high-value nutritious product can deteriorate and rot in a matter of days or even hours. A series of sophisticated technologies have been developed and applied in post-harvest handling of horticultural crops in the developed countries. Pakistan has not been able to use these advanced technologies, owing to high cost or adaptability problems. Post-harvest losses, therefore, remain high.

The quality of fresh fruits and vegetables has a decisive effect on their value. This is particularly true when consumers have a high income and the market provides a wide choice of produce. It is not uncommon in local markets for high quality fruit to have a price two to three times higher than mediocre produce of the same kind.

While it is cultural practices which determine the quality of produce at harvest, proper handling ensures that the quality is preserved until the produce reaches the consumer. Quality assurance is a prerequisite for high-value fresh fruits and vegetables.

Causes and Magnitude of Post Harvest Losses

Post-harvest losses have many different forms. The most obvious loss is a quantitative loss, such as reduced weight and partial or total waste of a product due to decay or senescence. A less discernible loss is a qualitative one, such as deterioration in texture, flavor or nutritional value. Other forms include loss of viability of propagates and reduction in monetary value due to reduced prices.

Post-harvest losses can occur in the field, in packing areas, in storage, during transportation and in wholesale or retail markets. Severe losses occur because of poor facilities, lack of know-how, poor management, market dysfunction, or simply the carelessness of farmers or workers. Post-harvest losses may also occur at consumers homes, in the kitchen or on dinning tables.

However, losses after produce has left the retail market are generally difficult to control by agricultural means and, will not be covered in this research.

Estimates of the post-harvest losses of fruits and vegetables in Pakistan from mishandling, spoilage and pest infestation are put at 35 percent; this means that more than one-quarter of what is produced never reaches the consumer for whom it was grown, and the effort and money required to produce it are lost-forever. Fruit, vegetables and root crops are much less hardy and are mostly quickly perishable, and if care is not taken in their harvesting, handling and transport, they will soon decay and become unfit for human consumption. Estimates of production losses in Pakistan are hard to judge, but some authorities put losses of mangoes, dates, tomatoes, bananas, chilies and onion sometimes as high as 50 percent, or half of what is grown. Reduction in this wastage, particularly if it can economically be avoided, would be of great significance to growers and consumers alike.

In order to promote horticultural industry in Pakistan, Standardization of postharvest and management technologies, minimizing post harvest losses and determine the ways and means to enhance foreign exchange are essentially required.

i) Describe the project and indicate existing facilities in the area and justify the establishment of the Project.

Post harvest handling has a decisive effect on the extent of post-harvest losses, the final quality, and the market value of horticultural crops. Modern technologies applied in grading, packaging, pre-cooling, storage and transportation, which minimize losses, preserve quality and enhance value-added of horticultural crops, have been used successfully in developed countries. However, some modifications, particularly of the equipment and facilities used, may be necessary in order to make them practical in small scale farming systems.

Modern harvest technologies developed over the past twenty or thirty years are now widely used in many countries. There several reasons why Western technologies cannot be applied quickly in Pakistan. Firstly, Western technologies cannot be applied quickly in Pakistan. Firstly, Western technologies use sophisticated equipment and facilities which are too large for the small-scale farming systems of Pakistan. There is some small-scale equipment manufactured in Europe or Japan, but is too expensive for poor

countries. Secondly, advantages of applying Western technologies are less obvious in traditional marketing systems than in the supermarkets which dominate retail in western countries.

Large capacity coolers, waxes, grading and packing line facilities, etc. manufactured in the United States are designed for use in large packinghouses. Pakistani farmers not only have small-scale operations, but also grow diverse crops. Their products are either packed by the growers themselves, or in small packing sheds operated by farmers' cooperatives. The volume each grower or cooperative packs each day is too for large equipment. Although smaller equipment is often made in European countries and Japan, it is always sold.

Modern supermarkets have refrigerated display cabinets and temporary cold storage. They keep produce cool continuously, provided it has been properly cooled before arrival. In contrast, rational markets do not usually have refrigeration. They make every effort to sell produce quickly to reduce display time and avoid quality loss. Even if the produce has been cooled before and during shipping, the "cold chain" breaks at the retail markets and hence reduces the benefit to cooling. Even worse, many consumers mistakenly believe that cold produce has been stored, while warm produce means it is "fresh". This misconception further discourages cooling, which is the most effective way to prevent rapid deterioration of the produce.

Modification of High Technology Facilities to Suit Local Needs

If the capacity of a packing shed is small, only small-scale equipment is needed. If a farmers cannot afford to buy expensive equipment, cheaper equipment should be developed. In order to lower the price, it may be necessary to sacrifice quality in terms of appearance, convenience, mobility and durability and/or user friendliness. Sacrificing one or more of these attributes might be acceptable at the initial stage of development, provided that the equipment still functions well. In order to encourage users to purchase, the equipment must be sold at on affordable price.

Since no post-harvest technology can remedy quality which is already damaged, a mistake at one point may not be compensated by extra care in other steps. Therefore, an integrated program covering all post-harvest procedures is necessary to guarantee success. For instance, if three steps in the post-harvest handling systems need to be improved, they all have to be improved simultaneously. Improving only one or two steps may not be any improvement at all. In order to provide shippers, extension staff and

marketing personnel with the essential technical knowledge, a number of short training course will be offered.

Existing technologies for cooling, storage, and transpiration of horticultural corps are generally adequate at present. New research should aim at improving equipment, facilities and methods, to make them more efficient and less costly. Different corps often need different post-harvest treatment. Post –harvest horticulturists must establish the requirements for each major corps. Even if optimum conditions and best treatments are known, it is often worthwhile to study the crop's response to less than optimum conditions, since the best treatment is not necessarily the most economic one. Cave storage is also going to be studied. When these experiments are completed, we shall be able to make recommendations for growers, depending on their specific on their specific location and the duration of the storage.

Since improved handling methods often rely heavily on improvements in equipment ad facilities, close cooperation between post-harvest horticulturists and agricultural engineers is necessary.

An areas which is urgently in need of new technology is post-harvest disease and insect control. Effective fungicides for post-harvest application have become fewer and fewer, since many previously used fungicide are now banned for fear of health hazards. Control of post-harvest decay must rely on new, safe chemical treatments and practical physical methods, in addition to improved sanitary conditions.

The present project has been designed keeping view these aspect. The methodology in the project will reduce or minimize the post harvest losses. Thus a full fledge sector will emerge in the rural economy. The proposed project will help in using the abundance labor resources in the country in a most profitable way and it will serve as an engine of growth for the whole economy.

Post harvest technology centre was established at Mirpur Khas under the Asian Bank Marketing Development project in 1989-90. however, after the termination of the Project, the research at the centre was discontinued. Most of the post were abolished leaving few posts detailed as under:

No	Name of Post	BPS NO	Sanctioned Post	No. of posts filled	No of Posts Vacant
POST HARVEST TECHNOLOGY SECTION					
1	Postharvest Technologist	18	1	1	--
2	Stenographer	12	1	1	--
3	Junior Clerk	05	1	1	
4	Laboratory Assistant	06	1	1	--
5	Field Assistant	06	1	1	--
6	Naib Qasid	01	1	1	--
7	Chowkidar	01	2	2	--
POST HARVEST TECHNOLOGY CENTRE					
1	Horticulturist	18	1	1	--
2	Workshop personnel	15	1	--	1
3	Stenographer	12	2	2	--
4	Vehicle Driver	05	1	1	--
5	Cleaner	01	1	1	--
Total			**14**	**13**	1

ii) Provide technical parameters and discuss technology aspect of the project.

Post-harvest technologies which greatly influence the level of post-harvest losses and the quality of produce include grading, packaging, pre-cooling storage and transportation. Some products also require one or more of the following treatments: trimming, cleaning, curing disease or insect control, waxing, and ripening. The technologies which will be dealt under the project are summarized as under:

Grading

Essentially all fruits and vegetables sold in modern markets are graded and sized. Sophisticated marketing systems require precise grading standards for each kind of product. More primitive markets may not use written grade standards, but the products are sorted and sized to some extent. Typical grading facilities in large packinghouses include dumpers and conveyers. Products in graded by human eyes and hands, while moving along conveyor belts or rollers. "Electric eyes" are sometimes used to sort produce by color. In small-scale packing operations, are or a few grading tables may be enough. Dumping, covering and grasping can cause mechanical injury to

some products. Equipments should have a smooth, soft surface, and dumping and grading operations should be gentle, to minimize injuries.

Many products are sized according to their weight. Automated weight sizers of various capacity are used in packinghouses. Round or nearly round fruits are often sized according to their diameter, using automated chain or roller sizers or hand carried ring sizers. An inefficient sizing operation can also cause significant injuries. Under this project grading technologies will adopted as per local environment.

Packaging

There are two very different types of packaging. The first is when produce is packed in containers for transportation and wholesale. The second is when produce is packed into small retail units. Idea containers for packing fruits and vegetables should have the following attributes. They are easy to handle, they provide good protection from mechanical damage, they have adequate ventilation, and they are convenient for merchandising (i.e. they can easily carry printed information and advertising about the product etc.). They should also be inexpensive, and easily degradable or recyclable. Many kind of containers have been

Used, but the "idea" is yet to be found. Users often put economic considerations first in selecting containers. Fancy containers such containers. Fancy containers such as fiberboard boxes, or wooden or plastic crates, are often used for high-value products. Inexpensive containers such as polyethylene bags or nylon net sacs are used for low-priced produce.

Methods of packing can affect the stability of products in the containers during shipping, and influences how much the containers products their quality. In fiberboard boxes, for example, delicate and high-priced products are often packed in trays, while other products are simply all put in the box together. Prepackaging or consumer packaging generally provides additional protection for the products. It is also convenient for retailers as well as customers, and therefore adds value to produce. Hoverer, overuse of non-biodegradable plastic treys and wrapping materials, as often seen in modern supermarkets, creates an extra burden of waste disposal and damages the environment.

Pre-cooling

Good temperature management is the most effective way to reduce post-harvest losses and preserve the quality of fruits and vegetables. Desirable storage and transportation temperatures for major frits and vegetables have been identified and published. Temperature which are low, but not low enough to cause chilling-injury, slow done physiological activity and hence the rates of senescence of the products. Low temperatures also reduce microbial growth rates and the rate of decay.

Product harvested from hot fields often carries field heat and have high rates of respiration. Rapid removal of field heat by pre-cooling is so effective in quality preservation that this procedure is widely used for highly perishable fruits and vegetables. Currently used pre-cooling methods include room cooling, forced-air cooling, water-cooling, vacuum cooling, and package icing. Smaller capacity equipment can be made using the same principles of large commercial equipments.

Room cooling is a relatively simple method which needs only a refrigerated room with adequate cooling capacity. The produce is packed in containers which are loosely stacked in the cooling room, leaving enough space between containers for each one to be exposed to circulating cold air. The rate of cooling is rather slow compared to other methods of cooling, because of cooling, because the heat inside each container needs to be transferred to the surface of the container by means of conduction before being carried away by the refrigerated air. It may take hours or even days to cool a product, depending on what king of product it is, the size and nature of the container, and the temperature and velocity of the circulating air.

Forced-air cooling is a more rapid way of using air to cool produce. Cold air is forced to flow through the inside of each container, so that it carries away heat directly from the surface of the produce rather than from the surface of the container. The air flow is produced by creating a pressure difference between the two perforated sides of each container. The containers are stacked inside a covered tunnel with an exhaust fan at one end. Highly perishable and high-value products such as grapes, strawberries and raspberries may be cooled in the less than an hour using this methods.

Water cooling (also known as hydro-cooling), I a rapid and less expensive methods. Produce in exposed to cold water by means of showering or dipping. The required cooling time is often a matter of minutes. However, not all kinds of products tolerate hydro-cooling. Hydro-cooled product

inevitably have a wet surface, which many encourage decay in some kinds of produce. Cooling by ice also inevitably wests both the produce and container, and generates water which needs to be drained.

Storage

Many horticultural crops have a relatively short harvesting season. Storage is needed to extend the marketing period. Various storage methods have been sued on a commercial scale. Air cooled common storage houses are often, used or underground or cave storage using natural cold air. Storage humidity is sometimes regulated by controlled ventilation and dehumidifiers. Refrigerated storage (cold storage) controls temperature and humidity precisely by mechanical means. Controlled atmosphere (CA) storage controls the concentrations of oxygen and carbon dioxide, in addition to temperature and humidity. Modified atmosphere (MA) storage also controls oxygen and carbon dioxide concentrations, although not as precisely as in CA, by using semipermeable polymeric films. Ethylene may be scrubbed for products responsive to it, regardless of the storage system used. A good control of temperature, humidity and atmospheric composition maximizes the storage life span of a product.

Air-Cooled Common Storage

This is widely used for storing horticultural products, particularly those which good keeping quality even without a precise low temperature. However, its use is generally limited to cool seasons in temperate and subtropical regions, or high altitude areas where there are low ambient temperatures at night. An idea storage room is adequately insulated and has a good ventilation control system which pulls cool air in at night and keeps warm air out during the day.

Large commercial-scale storage of horticultural products in caves and underground cellars are seen only in northern and central China. The major crops stored are apples, pears and citrus fruits. Underground or cave storage often provided better temperature control than above-ground air-cooled storage. This method is most useful in areas where there is a long, cold winter, a dry climate, and a thick layer of fine heavy soil. The construction and management technologies developed in China do not yet seem to have spread to other countries. Some modification of Chinese technologies to suit different climatic and soil conditions might well make this technology useful in many parts of the world.

Refrigerated Storage

Refrigerate storage is a well-established technology widely used for storing horticultural crops all over the world. Its application is limited only by cost and benefit considerations. Essentially, all crops can benefit by being stored at a suitable low temperature which extends the storage life and preserves quality. However, these benefits sometimes do not cover the cost of refrigeration, if the price of the products is too low. Another problem is how to make full use of refrigerated storage for a long period each year. Many horticultural crops have storage life spans reneging form les than one month to several month when refrigerated. Therefore, refrigerated storage can be used continuously only if several different crops with different harvesting season can share the facility.

There are other important season why this methods is not used in many tropical and sub-tropical courtiers, where refrigerating is needed most. The initial investment cost is too high and its energy consumption too large for many countries.

iii) Provide details of civil works, equipment, machinery and other physical facilities required for the project	Sr#	Material	Approved cost	Qty	Revised cost
	1	Probe Thermometer	0.020	1	**purchased**
	2	Banana Caliper	0.004	1	**0.018**
	3	Digital Refrectometer	0.020	1	**purchased**
	4	Ethylene Generator	0.010	1	**0.225**
	5	Electronic Fruit Size measurer & Data Logger	0.040	1	**0.044**
	6	Fruit Texture Analyser	--	1	**0.300**
	7	Humidity Controller	0.013	1	**purchased**
	8	Mechanical Fruit Firmness Tester	0.015	1	**0.120**
	9	Walk in Storage	1.900	1	**purchased**
	10	Hydro-cooler	0.480	1	**0.150**
	11	Dates Boiler	--	1	**2.200**
	12	Steam Generator	2.000	1	**2.000**
	13	Motorcycles	--	2	**0.120**
	14	Dates Drying Tunnel	0.500	1	**0.500**

iv) Indicate governance issues of the sector relevant to the project and strategy to resolve them

Agriculture Department, Government of Sindh will be the executing agency of the project and it will monitor the implementation of the project. The research on the postharvest technology will be conducted at Sindh Horticulture Research Institute, Mirpurkhas. The Aasim Agriculture Farm, Tando Allahyar, Anwar Bachani Farm, Tando Allahyar, and Local and Karachi markets will be associated to do the supply chain analysis.

• Indicate benefits of the research to the economy	The farmers are the ultimate beneficiaries of the project who will be benefited by the findings of the project. Their participation will be ensured at appropriate time for transfer of technology and advisory services.
• Mention number of studies/papers to be produced	Not applicable
• Indicate whether these studies would result in commercial application of the process developed (if applicable)	The technology developed under this project will be transferred to the end users for commercial application.
7. <u>Capital cost estimates</u> Indicate date of estimation of project cost.	Original July 2007 Revised : 2008
• Basis of determining the capital cost be provided. It includes market survey, schedule rates, estimation on the basis of previous work done etc.	The cost estimates have been calculated on prevailing market rates.

- Provide year-wise estimates of physical activities by main components as per following

1ST YEAR

PHYSICAL TARGETS

Sr#	Physical Targets	Amount allocated
1	Selection of model farms, two each at Tando Allahyar and Mirpurkhas	**5.000 million**
2	Application of hormones, fertilizer and pesticides at selected farms on two areas each of mangoes	
3	Pruning of mangoes and Guava	
4	Controlled harvesting, precooking and packing of mango, dates and guava	
5	Studies on marketing and storage of fruits and vegetables	
6	Control of postharvest diseases in onion and chillies	
7	Conduct experiments on onion storage	
8	Monitoring of fruit flies in mango, guava and ber gardens	
9	Develop IPM control strategies against fruit flies	
10	Calculate the cost benefit ratios	

PHYSICAL ACHIEVEMENTS

I. M A N GO

Sr#	Physical progress	Amount allocated
LOCATION-1 Anwar Bachani Farm Tando Allahyar		**5.000 million**
Field and Nutrients Management in experimental mango orchard		
1	Plowing was done with tractor and farm yard manure was applied. The farm yard manure was processed by plowing the field with Disc harrow.	
2	Laser Leveling of the fields	
3	Trunk Rings were prepared for each experimental mango tree	
4	Dried branches were pruned with Secateur and Saw	
5	Bordeaux paste was applied on all the pruned branches and on trunks 3ft high from the soil surface.	
6	Preparation of Bordeaux paste includes: Copper sulphate 2 kg, Lime 2 kg (at the rate of 2:2:50) which was dissolved in water separately over night in plastic buckets and was mixed in the morning, 50 litters water and pasted over the trunk.	
7	DAP and Urea, SOP Fertilizers were also applied as per the recommended dose.	
8	The recommended dose of phosphorus for mango (26 trees per acre), DAP 1.00 kg /tree and 1.5 kg/tree Sulphate of Potash (SOP).	
9	The recommended dose of Nitrogen for mango was applied at 2 kg per tree.	
10	The recommended dose of Potash for mango was applied at 2 kg per tree.	
Spray applications on experimental mango orchard		
11	1st spray with Topsin+Score in the month of February 2008	
12	2nd Spray with Topsin in the month of March 2008	
13	3rd spray with Topsin + Score on 15th March 2008	
Other operations		
14	Pheromone traps against Anthracnose and Fruit flies	
15	Worked to remove malformation in mango trees	
16	Local mango growers, Malhis, mango exporters, mango contractors were trained in controlled picking of mango fruits, desaping, grading, packing, storage etc.	
17	Local mango growers, Malhis, mango exporters, mango contractors were also trained in using refrectometer to determine the proper fruit maturity in mango. Moreover, information on fruit harvesting tool (mango harvester) was also given to all the above trainees during this demonstration.	

LOCATION-2 Syed Ali Gohar Shah Farm Mirpurkhas	
1.	All the operations (Sr.1-15) at Location-1 were repeated at location No.2
2.	Conducted seminar on postharvest technologies of mango and demonstrated controlled picking, desaping, grading, packing, storage etc.
3	During this seminar 50 Malhis and 30 mango growers, mango exporters, mango contractors, researchers and extensionists were trained in controlled picking of mango fruits, desaping, grading, packing, storage etc.
4	Mango growers, Malhis, mango exporters, mango contractors, researchers and extensionists were also trained in using refrectometer to determine the proper fruit maturity in mango. Moreover, information on fruit harvesting tool (mango harvester) was also given to all the above trainees during this demonstration.
LOCATION-3 Sindh Horticulture Res Inst Mirpurkhas	
1	All the operations (Sr.1-15) at Location-1 were repeated at location No.3
2	Some 250 persons of various categories were trained in controlled picking of mango fruits, desaping, grading, packing, storage etc. which include Local mango growers, Malhis, mango exporters, mango contractors
3	Moreover, local mango growers, Malhis, mango exporters, mango contractors were also trained in using refrectometer to determine the proper fruit maturity in mango. Moreover, information on fruit harvesting tool (mango harvester) was also given to all the above trainees during this demonstration.

II. DATE PALM

Sr#	Physical progress
Location: Date Palm Research Station, Kotdiji	
Field and Nutrients Management in experimental Date palm orchard	
1	70 plants of Aseel variety were selected and marked as experimental trees
2	Plowing was done with tractor using different implements
3	The Trunks were earthen up (Dhikka)
4	Farm Yard Manure, DAP and SOP fertilizers were applied at the recommended dose.

5	The pollination of the date trees was carried out manually on while blocks
6	Pruning of dried leaves of experimental date palm trees was done manually before fully opening of flowers and fruit setting.
7	Manual fruit sorting at the trees was carried out to remove the weaker and diseased fruits to get the fruits of high quality.
8	All the experimental trees were sprayed with Cypermethrin before

	pollination in the end of January 2008
9	Proper drugs were used against ants and other common insects.
10	The Date Palm growers, Malhis and contractors of the area were trained in postharvest handling and other storage technologies of dates to improve shelf life and quality of the fruit
11	The growers were also given training, how to carry out pollination in Date Palm.
12	The people of the area were also given effective information in fruit harvesting methods and proper handling during harvesting process
13	Further mechanized postharvest technologies could be performed subject to availability of equipments and machinery.

2ND YEAR

PHYSICAL TARGETS

Sr#	Physical Targets	Amount allocated
1	Continuation of the research work as explained in the physical targets for first year	**28.112 million**
2	Determination of quality parameters, regarding occurrence of diseases, physiological disorders during the entire supply chain of frui7ts and vegetables	
3	Study the aflatoxin levels in chilies after drying in controlled environment	
4	Monitoring of fruit flies	
5	Organize field days	
6	Transfer of technology to the growers	
7.	Construction of Water Course at A.R.I Tando jam	

In case of revised project provide.

I) Project approved history alongwith PSDP allocation release and expenditure	The project was approved during the financial year 2007-08 with an allocation of Rs: 5.000 million and released Rs: 3.160 million. The expenditure incurred was Rs: 3.120 million

Year	Allocation	Release	Expenditure
2007-08	5.000	3.160	3.120
2008-09	28.211	--	---

II. Item wise year wise actual expenditure and physical progress.

FINANCIAL PROGRESS (1st YEAR 2007-08)

Sr #	Head of Accounts	Allocation (Millions)	Expenditure	Achievements
01	Contingent Paid Staff	0.650	00	-
02	Traveling Allowance	0.100	0.100	The project covers four locations i.e. (i)Head Quarter (Mirpurkhas), (ii) Syed Ali Gohar Shah Farm, Jhalori Road, near Mirpurkhs, (iii) Anwar Bachani Farm, Tando Allahyar and (iv) Date Palm Research Station, Kotdiji. For periodical research activities visits were conducted and the amount was spent on actual basis.
03	P.O.L.	0.100	0.100	For conducting survey vehicle was needed and there are four locations covered by the project and obviously lots of movement of vehicle. Moreover, continuous use of tractors for various field operations also consumed fuel, mobile oil etc. Hence, the allocated amount was actually spent for project purposes.

04	Office Stationery	0.050	0.050	This project is being executed to solve the problems from grassroot level. Hence, a considerable paper work, printing of copies from computer, computer supplies etc. were needed and the amount was spent on actual basis.
05	Cost of Other Stores	0.528	0.528	The above amount was spent on purchase of fertilizers, pesticides, farmyard manure, fungicides, preparation of field boards. Moreover, rates of fertilizers increased manifold, thus the amount under this head is already meager to meet the actual requirements.
06	Chemical and Glassware	0.300	0.300	Chemical and glassware have been purchased for newly established laboratory.
07	Other Misc.	0.100	0.100	Under this head, the allocated amount was spent on preparation of display boards, laboratory fascination etc.
08	Physical Assets	3.002	1..822	From this head of account following machinery has been purchased: 1. Probe Thermometer (One) 2. Digital Refrectometer (One) 3. Humidity Controller (One) 4. Walk and Storage (Tenders invited)
09	Repair of Transport	0.100	0.100	Two vehicles (GS-5043 and FIAT Pickup GS-4075) needed major repairs.
10	Repair of Furniture	0.020	0.020	The old furniture and fixtures needed repair, which has got been done.
11	3rd Party Monitoring	0.050	0.000	-
	TOTAL:	**5.000**	**3.120**	-

*** Item wise comparison of revised cost with the approved cost and give reason for variation.**	**The variation in the project cost is attributed due to increasing cost of commodities. The previous cost do not fulfill the desired requirements.**
*** Indicate exchange rate used to work out FEC in the original and revised PC-I.**	**No exchange rate used**

Year wise Financial requirements

Sr.#	Item	1st YEAR			2ND YEAR			Total		
		Total	Local	FEC	Total	Local	FEC	Total	Local	FEC
1		3.120	3.120	-	27.932	27.932		31.052	31.052	-
2	3rd party monitoring 1%	-	-	-	0.279	0.279		0.279	0.279	-
	Total:	3.120	3.120	-	28. 211	28.211		31.331	31.331	-

SUMMARY OF THE PROJECT COST

Particular	APPROVED Cost		Incurred	To be incurred	Total
	2007-08	2008-09	2007-08	2008-09	
Research follow	0.450	0.540	--	0.540	0.540
Lady field Assistant	0.200	0.240	--	0.240	0.240
DPL 10 person	---	--	--	0.252	0.252
Repair & Maintenance	0.120	0.080	0.120	0.280	0.400
Commodities Service	1.178	1.120	1.178	2.070	3.248
Physical Assist	3.002	3.300	1.822	5.677	7.499
Construction of Water course A.R.I Tandojam	--	--	--	18.873	18.873
Total:	4.950	5.280	3.120	27.932	31.052
Monitoring Cost	0.050	0.053	--	0.279	0.279
Grand Total	5.000	5.333	3.120	28.211	31.331

Budget Requirements (Million Rupees)

Sr#	Particulars	Actual 2007-2008		Actual 2008-2009		Total
		Allocation	Expenditure	Allocation	Revised	
	Contractual Services					
1.	**01** Research Fellow (Chemistry) @ Rs. 15000 PM	0.150	--	0.180	0.180	**0.180**
2.	**02** Research Fellows (Hort) @ Rs. 15000 PM	0.300	--	0.360	0.360	**0.360**
3.	**04** Lady Field Assistant @ Rs. 5000 PM	0.200	--	0.240	0.240	**0.240**
4.	**10** Daily Paid Labour @ Rs. 2100 PM	--	--	--	0.252	**0.252**
	Total	**0.650**	--	**0.780**	**1.032**	**1.032**
A)	**Repair & Maintenance**					
1	Transport	0.100	0.100	0.030	0.150	**0.250**
2	Machinery & Equip.	--	--	0.030	0.050	**0.050**
3	Furniture & Fixture	0.020	0.020	0.020	0.080	**0.100**
	Total	**0.120**	**0.120**	**0.080**	**0.280**	**0.400**
B)	**Commodities & Services**					
1	Traveling Allowance	0.100	0.100	0.100	0.150	**0.250**
2	P.O.L. Charges	0.100	0.100	0.100	0.300	**0.400**
3	Stationery	0.050	0.050	0.050	0.050	**0.100**
4	Printing Charges	--	--	--	--	--
5	Postage & Stamps	--	--	--	--	--
6	Telephone charges	--	--	--	--	--
7	Hot & Cold W.Ch.	--	--	--	--	--
8	Electricity Charges	--	--	--	--	--
9	Publicity & Advert.	--	--	--	--	--
10	Cost of Other Stores	0.528	0.528	0.500	1.000	**1.528**
11	Fair Exhibition	--	--	--	0.200	**0.200**
12	Chemical & Glassware	0.300	0.300	0.250	0.250	**0.550**
13	Other Misc.	0.100	0.100	0.120	0.120	**0.220**
	Total	**1.178**	**1.178**	**1.120**	**2.070**	**3.248**

Conti,..P/2

C)	**Physical Assets**					
1	Probe Thermometer	0.020	0.020	--	--	**0.020**
2	Banana Caliper	0.004	--	--	0.018	**0.018**
3	Digital Refrectometer	0.020	0.020	--	--	**0.020**
4	Ethylene Generator	0.010	--	--	0.225	**0.225**
5	Electronic Fruit Size measurer & Data Logger	0.040	--	--	0.044	**0.044**
6	Fruit Texture Analyzer	--	--	0.300	0.300	**0.300**
7	Humidity Controller	0.013	0.013	--	--	**0.013**
8	Mechanical Fruit Firmness Tester	0.015	--	--	0.120	**0.120**
9	Walk in Storage	1.900	1.769	--	--	**1.769**
10	Hydro-cooler	0.480	--	--	0.150	**0.150**
11	Dates Boiler	--	--	1.00	2.200	**2.200**
12	Steam Generator	--	--	2.000	2.000	**2.000**
13	Motorcycles	--	--	--	0.120	**0.120**
14	Dates Drying Tunnel	0.500	--	--	0.500	**0.500**
	Total C:	**3.002**	**1.822**	**3.300**	**5.677**	**7.499**
D	**Construction of Water Course A.R.I**					
	20% Agriculture Engg:	--	--	---	**7.549**	**7.549**
	labour Charges	--	--	--	**11.324**	**11.324**
	Total D:	--	--	--	**18.873**	**18.873**
	Total A+B+C+D	**4.950**	**3.120**	**5.280**	**27.932**	**31.052**
	3rd Party Monitoring	**0.050**	--	**0.053**	**0.279**	**0.279**
	Grand Total	**5.000**	**3.120**	**5.333**	**28.211**	**31.331**

The project will be funded through ADP of Government of Sindh.

8 (A) Annual operating and maintenance cost after completion of the project

The postharvest research is the regular feature of the SHRI Mirpurkhas. The funding will be met through the non-development allocations.

The recurring expenditures required during next five years will be Rs. 2.382, 2.392, 2.412, 2.432 and 2.452 for each year, respectively.

Sr#	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year
	Contractual Services					
1.	01 Research Fellow (Chemistry) @ Rs. 15000 PM	0.180	0.180	0.180	0.180	0.180
2.	02 Research Fellows (Hort) @ Rs. 15000 PM	0.360	0.360	0.360	0.360	0.360
3.	04 Lady Field Assistant @ Rs. 5000 PM	0.240	0.240	0.240	0.240	0.240
4.	Daily Paid Labour	0.202	0.202	0.202	0.202	0.202
	Total	0.982	0.982	0.982	0.982	0.982
A)	Repair & Maintenance					
1	Transport	0.150	0.150	0.150	0.150	0.150
2	Machinery & Equipments	0.050	0.050	0.050	0.050	0.050
3	Furniture & Fixture	0.080	0.080	0.080	0.080	0.080
	Total	0.280	0.280	0.280	0.280	0.280
B)	Commodities & Services					
1	Traveling Allowance	0.150	0.150	0.160	0.160	0.160
2	P.O.L. Charges	0.300	0.300	0.31	0.330	0.340
3	Stationery	0.050	0.050	0.050	0.050	0.050
4	Cost of Other Stores	0.500	0.500	0.500	0.500	0.500
6	Other Misc.	0.120	0.130	0.130	0.130	0.140
	Total	1.12	1.13	1.15	1.17	1.19
	Grand Total	2.382	2.392	2.412	2.432	2.452

9. (A) Demand supply analysis (excluding science & technology, research, governance & culture, sports & tourism sectors)

Not applicable

10. (A) Financial Plan	

(a) Equity:	---
Indicate the amount of equity to be financed from each source	
• Sponsors own resources	---
• Federal government	---
• Provincial government	---
• DFI's / banks	---
• General public	---
• Foreign equity (indicate partner agency)	---
• NGO's / beneficiaries	---
• Others	---
11. (A)	
(a) Project benefits and analysis	
• Financial:	---
• Social:	---
• Environmental:	There will be no hazards & pollution in the environment due to this project. On the contrary the environment will be improved due to the use of IPM technology.
(b) Project analysis:	
• Quantifiable output of the project	
• Unit cost analysis	
• Employment generation (directed & indirect)	Skilled --- Un-skilled ---
• Impact of delays on project cost and viability	Assumptions for affecting the implementation of the project are as under: • Less release of funds • Late release of funds • Unforeseen hazards

12. PROPOSED IMPLEMENTATION PLAN

S.#	Particulars	1st year				2nd year			
		Quarter				Quarter			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th
1	Contractual staff								
2	Repair & maintenance								
3	Commodities & services								
4	Probe thermometer								
5	Banana Caliper								
6	Digital refractometer								
7	Ethylene generator								
8	Electronic fruit size measure & data logger								
9	Fruit texture analyzer								
10	Humidity controller								
11	Mechanical fruit firmness tester								
12	Walk in storage								
13	Hydro-cooler								
14	Hot water treatment								
15	Steam generator								
16	Motor cycles								
17	Construction Water Course								

13. Management structure and manpower requiems

- Administrative arrangements for implementation of the project

Director General, Agriculture Research Sindh, Tandojam, will be the team leader and director, SHRI, Mirpur khas and director A.R.I. Tandojam will be the Co-Team leader for implementation of the project as technical experts.

- **Manpower requirements during execution and operation of the project would be provided by skills/profession.**

(a) Manpower

Skilled:

Research fellow (chemistry line)	1	@ Rs. 15,000/= P.M.	22 mm
Research fellow (Horticulture line)	2	@ Rs. 15,000/= P.M.	44 mm
Lady Field Assistant	4	@ Rs. 5,000/= P.M.	88 mm
Contractual Labour (Unskilled)	10	@ Rs. 21,00/- P.M.	176 mm
		Total	**330 mm**

(b) Give list of employment to be generated by Gender.

Not applicable

(c) Give man power required during the 1st year of the implementation of the project. Give details of specific skills required (scientist, lab/field workers, technical etc) separately for male & female and their grades.

(d) Like short of man power by occupation.

No shortage of man power

(e) Steps to be taken to ensure availability of man power.

It will be available locally.

(f) Approximate number of persons to be trained per year (locally and abroad) and the kind of skill to be learnt.

100 growers will be trained locally on post harvest technology through field days.

- **Job description, qualification, experience, age and salary of each job would be provided.**

  - **Research (fellows (chemistry line) @ Rs. 15,000/= P.M.**
    - He will be stationed at SHRI Mirpur khas.
    - He will be conducting the quality analysis of targeted fruits in the laboratory.
    - Monitor the quality of fruits and vegetables through entire supply chain.
    - Report writing.
  - **Research (fellows (horticulture line) @ Rs. 15,000/= P.M.**
    - One research fellow will be stationed at Tando Allahyar and other at SHRI Mirpur khas.
    - They will look after the experiments at the model farms.
    - Each of them will be provided one motor cycle and 20 litres petrol per month. The cost of motor cycles will be deducted from their pay in 22 instilments.
    - They will be conducting postharvest experiment on the quality of frits and vegetables in the supply chain.
  - **Lady field assistant @ Rs. 5, 00/= P.M.**

The field Assistant will assist in laying out the field trails at the laboratory and farmers field. He should be having a Field Assistant training course with 2 years experience. The Field Assistant will be hired during the entire period of the project. This will provide the job opportunities to the trained lady field assistants from ATI Sakrand, most of whom are job less. They will provide the help in conducting the experiments on postharvest technologies.

  - **Daily paid Labour (Unskilled) Rs. 2100/- P.M.**

The daily paid labour will be utilized during various field operations during the project period. About 8 unskilled labour will be appointed.

14. (A) ADDITIONAL PROJECTS/DECISIONS

----------NIL----------

15. Certified that the project proposal has been prepared on the basis of instructions provided by the Planning Commissions for the preparation of PC-1 for Social Sector Projects.

(DR. ATTA HUSSAIN SOOMRO)
Prepared by: *DIRECTOR AGRICULTURE RESEARCH INSTITUTE*
TANDOJAM

(HIDAYAT ULLAH CHHAJRO)
DIRECTOR GENERAL
AGRICULTURE RESEARCH INSTITUTE
TANDOJAM

Checked by: ***(DIRECTOR)***
PLANNING & MONITORING CELL
AGRICULTURE DEPARTMENT
GOVERNMENT OF SINDH
KARACHI

(ASLAM ALI)
ADDITIONAL SECRETARY (TECH.)
AGRICULTURE DEPARTMENT
GOVERNMENT OF SINDH
KARACHI

Approved by: ***(SABHAGO KHAN JATOI)***
SECRETARY
AGRICULTURE DEPARTMENT
GOVERNMENT OF SINDH
KARACHI

(A) JUSTIFICATION OF BUDGET DEMANDED	
A. REVENUE:	
Contractual staff	An amount of Rs.1.830 million has been proposed for the payment to contractual staff, to work in laboratory and model farms.
Repair & Maintenance	An amount of Rs.0.400 million has been proposed for this head. Rs.0.250 million are demanded for the repair of old transport which will be used in the project, Rs.0.050 million for machinery & equipments and furniture & fixture (0.100 million), which requires urgent repair during whole period of 2 years.
	Three old vehicles are kept to do the project work (X-68-2116, GS-5129 & GS-5043).
	Following machinery present at SHRI will be repaired and used for the analytical work. **Laboratory Equipments:** Autoclave & Oven **Field Machinery** Tractor MF-375
Commodities & Services	An amount of Rs.3.248 million has been proposed for commodities & services. The details are as under: • An amount of Rs.0.250 million has been proposed for T.A. to be paid to the staff involved in research work for a period of two years. List of the staff is given at Page # 8 alongwith staff mentioned. • An amount of Rs.0.400 million has been proposed for P.O.L. charges required for transport, to be used in the project work

	during two years. The list of vehicle is given above. Moreover, the POL will be provided to the research fellows for motor cycles @ 20 litres per month • An amount of Rs.0.100 million has been proposed for the purchase of Stationery Items required for project work during the project period. • An amount of Rs.1.528 million has been proposed for cost of other stores for the purchase of fertilizer, weedicides, pesticides, farm yard manure etc. to be used for conducting field experiments during the project period. These will be provided to the model farms also. • An amount of Rs.0.200 million has been proposed for fair & exhibition, organizing the field days for transfer technology process to the growers. • An amount of Rs.0.550 million has been proposed for the purchase of chemicals & glass wares used for analysis of fruit samples in the laboratory and purchase of growth regulators. • An amount of Rs.0.220 million has been proposed to meet the unforeseen expenditure during the project period and purchase of labels, gunny bags, feed required for insect rearing etc.
B. Physical Assets	
Machinery & Equipments	Probe Thermometer: The equipment will be used to determine the internal temperature of fruits and vegetables. Banana Caliper: The equipment will be used to determine the size of the banana fruit.

	Digital Refratometer: The equipment will be used to determine the total soluble solids of fruits and vegetables. Ethylene Generator: For ripening of the fruits. Electronic fruit size measure & data logger: To measure the size of the fruits. Fruit texture analyzer: Determines the texture and hardness of the fruit. Humidity Controller: Provides controlled humidity to the fruits during storage. Mechanical fruit firmness tester: Determines the hardness of the fruits. Walk in Storage: Conduct experiments on the storage of fruits and vegetables. Hot water treatments: Hot water treatment is requirement for export by many countries as it provides protection against fruit fly infection. Steam Generator: Steam generator is required by the food technology laboratory for sterilization of fruit juices. Motor Cycles: Motor cycles will be provided to the Horticulture Research Fellows for easy field and market movement on ownership basis. The cost of motor cycles will be recovered from their pay.
(C) Construction of water course, A.R.I Tandojam	The detail length of water couse cotton, sugarcane, Plant Pathalogy, Oilseeds, Wheat Research Station, Agriculture Chemistry, Pulse Research Station Tandojam, Jujube Research Station, Tandojam. Total square ft. 24155 ft.