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Comparative Economic Analysis of Hybrid Rice v/s Conventional Rice Production in District Badin Sindh Province Pakistan

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Abstract
Pakistan grows high quality rice including Fine and Course grain varieties, coarse grain varieties are early maturing while fine grain varieties are late maturing. Both fine and coarse grain varieties have Hybrid and Conventional Rice varieties which are high quality rice to fulfill domestic demand and also for exports. The study was design to compare the economic analysis of Hybrid and Conventional Rice production, major objectives of the study were to asses' financial gain from Hybrid Rice comparing with Conventional Rice and Taluka Golarchi was selected for the present study where both on Hybrid and Conventional Rice varieties are grown, primary data on Hybrid and Conventional Rice was collected from the farmers through personal interviews with the help of specially designed questionnaire. A simple random sampling technique was used to collect the data. Cobb-Douglas production function was used for yield analysis. Total costs per acre of Hybrid Rice were 62010.87 Rs/Acre which were more than Conventional Rice was 56972.09 Rs/Acre. Major differences in hybrid rice production cost are related to higher seed prices, slightly higher land management costs. On an average higher yield (79.41monds per acre) was obtained from Hybrid Rice while Conventional Rice yield (59.74monds per acre) was less then Hybrid Rice. There was 14.14% increase in Hybrid Rice yield comparing with conventional Rice which gives additional income to poor farmers, Price gained per mounds was almost the same in both activities. High profit was observed in Hybrid Rice and low profit was obtained in conventional Rice. Most of the farmers focused to grow Hybrid Rice due to high yield.
Keywords: Rice, Economics Analysis, Production and Marketing.

INTRODUTION

Rice is the seed of the monocot plants Oryza sativa . As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. It is the grain with the second-highest worldwide production, rice is the most important grain with regard to human nutrition and caloric intake, providing more than one fifth of the calories consumed worldwide by the human species. Rice cultivation is well-suited to countries and regions with low labor costs and high rainfall, as it is labor-intensive to cultivate and requires ample water. Rice can be grown practically anywhere, even on a steep hill or mountain. Although its parent species are native to Asia and certain parts of Africa, centuries of trade and exportation have made it commonplace in many cultures worldwide.(*FAOSTAT*, 2006)

Rice (*Oryza sativa* L.) is an important cereal food grain crop of the world with an excellent source of calories, in the form of starch, and has added benefits of providing protein with higher nutritional quality than other cereals grains. Different rice research institute i.e. IRRI, WARDA and USDA have a lot of germ plasma collections of rice for the improvement of rice varieties with respect to yield and yield contributing traits. Crop improvement program also depends on the utilization of germ spasm stock that is available in different rice research institutes of the world. Improving and increasing the world's supply will also depend upon the development and improvement of rice varieties with better yield potential, and to adopt various conventional and biotechnological approaches for the development of high yielding varieties that having resistance against biotic and a biotic stresses (Khush, 2005).

In Pakistan's economy Rice is second food source after wheat and is an important foreign exchange earning commodity fetching about $950 million annually. It is one of the highest water requiring crops, depending on early and late maturing varieties. Coarse grain varieties are early maturing while fine grain varieties are late maturing. Sixty two percent of total rice area is under fine varieties, 27 percent under course grain varieties, and 11 percent under of others varieties. Moreover, about 96 percent of fine varieties are grown in Punjab because there is suitable climate for maintaining the quality and aroma of these varieties. The yield of fine varieties is much lower than the course grain varieties but demand of fine rice is high in national and international markets. Most of the farmers prefer to grow fine varieties despite low yield high production cost

and more water requirement (Khushk *et al*. 2011).

Improvement of the rice grain yield is the only possible and potential strategy to attain increased rice produce because of the reduction in rice cultivating area (Cassman, 1999).Hence, rice varieties with higher yield potential must be designed to enhance the total rice production of the world. Grain yield in rice is a quantitative/polygenic character and highly influenced by environment. Different rice varieties and germ plasma lines were selected on the basis of yield and yield contributing traits. Association of yield with corresponding yield components should be considered in determines the selection criteria of germ plasma on the basis of the variation (Habib *et al.* 2005).

The success of breeding program also depends upon the amount of genetic variability present in the population and extent to which the desirable traits are heritable. Different morph physiological traits play a very important role for more rice production with new plant type characteristics associated with plant yield (Yang *et al.* 2008). Phonological properties of rice are also associated with the yield potential of the different rice varieties for the selection of the best varieties that further involved in rice breeding program (Shahidullah *et al.* 2009).

Thousands cultivars of rice have been evolved through selection which were cultivated in many centuries ago these were well adapted to the local environments. Many of those rice cultivars having good quality characteristics and higher yield potential under biotic and a biotic stress environments. Since the beginning of civilization, hundreds of locally adapted genotypes of aromatic rice's have evolved by human and through natural selection (Singh *et al.* 2000).

Study of genetic divergence among the plant materials is an important tool for the plant breeders for an efficient selection of the diverse parents that further using in crossbreeding program for the improvement of the rice varieties. Genetically diverse parents are more likely to contribute in breeding program for the introduction of new desirable traits that involved in the yield potential of the new plant. Parents identified on the basis of divergence for any breeding program would be more promising (Arunachalam *et al.* 2002).

The appearance of rice with bran (brown) and without bran (white) is important to the consumers. Thus, components of appearance traits are one of the first criteria for rice quality that breeders consider in developing new varieties for open release and commercial production (Dela and Khush, 2000). Grain morphology is an important traitin cereals and quantity of grain products (Breseghello *et al.* 2007).

Factors contributing to general grain appearance are grain size, shape and color. Intensive work has been done by breeders to select for bright, clear, translucent grains and spindly shape (Graham *et al.* 2009).

The rice seed length and width are the two important quantitative traits that closely related to the exterior quality of the rice (Shi *et al.* 2000). Genetic analyses of length and width of rice kernels have been reported by some of the researchers and most of the studies have shown that rice grain shape is quantitatively inherited (He *et al.* 2005). It has been shown that rice grain shape is controlled by triploid endosperm genes, cytoplasm genes, and maternal genes (Shi *et al.* 2005) and their genotype into environment interaction effects. The length, width and seed thickness is one of the quantitative measures of grain shape. Grain morphology i.e. color, size and shape having unique position for the breeders during the selection and evaluation process (Kasem *et al.* 2010).

It is thought to relate to the largest shape variation in small grain crops. On the other hand, length width ratio is the major genetic variation of rice grain shape and highly associated with the quantitative traits parameters and can be used in the breeding program for the improvement of the rice varieties (Iwata *et al.* 2010).

Rice is an important food crop and a major export item of Pakistan. It has been a major source of foreign exchange in recent years. Pakistan grows a high quality rice to fulfill domestic demand and also for exports. Rice account 4.9 percent of the value added in the agriculture and 1.0 percent of GDP. The area under rice crop in Pakistan during 2011-12 was 2571 hectares with total production of 6160 thousand Tons; whereas the total area of rice crop in Sindh was 361.2 hectares with total production 1230.3 Tones. Pakistan is an Agricultural country due to high increase in population it face major challenges of food scarcity, so for the completion of food needs of the peoples, need to grow high yielding varieties (GOP, 2012).

The term “hybrid rice” refers to the first-generation (F1) offspring of a cross of two genetically diverse parents that yields (performs) better than both parents due to manifestation of a biological phenomenon known as hybrid vigor or heterocyst. Farmers can benefit from hybrids if the F1 (hybrid) seeds are used for commercial cultivation; the grains produced on the commercial hybrid crop are unusable as seed for the next crop because, in the subsequent generations, the yield advantage expressed in the first generation offspring of a hybrid is significantly reduced due to inbreeding depression (asiabiotech). Hybrid rice typically displays heterocyst (or hybrid vigor) such that when it is grown under the same conditions as comparable high-yielding inbred rice varieties it can produce up to 30% more rice. High-yield crops, like hybrid rice, are one of the most important tools for combating world food crises (IRRI).

Traditional rice production (i.e., non hybrid rice) relies on rice varieties. A rice variety is a rice line that is a group of rice plants distinguished by common characteristics of significance to agriculture and often has been assigned a commercial name. When rice is produced from a variety, a single line is planted and it fertilizes

by self-pollination. When a rice variety is reproduced, it retains its distinguishing characteristics, and farmers can keep seeds for replanting next season (Potera *et al*. 2007).

Hybrid Rice was first commercially cultivated in China in 1976 and its area had been expanded to more than 13 million hectares by 1990, it proven to have 20% yield advantage over inbred rice in China (Yuan 2004). During the last decade, Vietnam, India, Philippines, Bangladesh and United States have also started its commercial cultivation. Hybrid rice not only has a distinct yield advantage over Conventional varieties but also is more responsive to fertilizer and can adapt to varying environments (Khushk et al. 2011).

Hybrid Rice is considered as the superior technology over the existing conventional modern Rice varieties. This technology is globally known since China announced the successful development and cultivation of the Rice Hybrids in 1976 (Kueneman 2006).

Chinese's income levels have increased, consumers demand for good quality Rice has increased, while Hybrid Rice varieties have not been able to meet this demand. There are evidence that farmers cultivating Hybrid Rice realized 16 percent higher yields than current Conventional varieties in similar agro-climatic zones of Karnataka and Andhra Pradesh. However, in Orissa and Tamil Nadu, India; Hybrid Rice gave lower yield due to pests and disease attack compared to conventional varieties. Hybrid rice research was primarily aimed at reversing the current yield trend in the intensively Rice growing regions. There are evidences to show that farmers cultivating Hybrid Rice realized higher yield gains at 16 percent over current Conventional varieties in similar agro-climatic zones of Karnataka and Andhra Pradesh (Janaiah 2001).

Currently, about 610,000 ha are covered with Hybrid Rice in Vietnam (340,000 ha), India (200,000 ha), Bangladesh (50,000 ha), USA (10,000 ha), Philippines (5,000 ha) and Myanmar (5,000 ha). These have given on average about 20-25% (1 - 1.5/ha) higher yields than the Conventional HYVs, thereby contributing towards higher on-farm productivity. Currently, Hybrid Rice technology is considered a viable option to increase Rice yields globally (Yuan *et al* 2000).

PARC/NARC has been conducting adaptability trials on rice hybrids in collaboration with Federal Seed Certification and Registration Department since 2005. So far, 367 rice hybrids supplied by different national and multinational seed companies have been tested for adaptability in National Uniform Yield Trial (NUYT). These trials were planted at various locations throughout the country. The crop stand of few hybrids was excellent and out yielded the commercial variety, IR-6. Fifty four rice hybrids have already been recommended by Variety Evaluation Committee (VEC) for further approval of National and Provincial Seed Councils for general cultivation. In addition, certain resource conservation technologies (RCTs) are being refined and disseminated through viable public-private partnership. In future, such collaborative activities will continue to strengthen the public-private partnership.

In Pakistan two Hybrid Rice varieties GNY50 and GNY53 have been introduced among the Rice growers in Sindh and Balochistan provinces. These varieties have created tremendous demand among Rice Growers and Consumers. Hence, government approved these varieties for commercial cultivation. Keeping in view the introduction of Hybrid Rice in Rice growing areas in Sindh and there is confusion among Rice Growers, Traders, Development Specialists and Policy makers about the Hybrid Rice and they face number of problems in adoption of this technology. Therefore, this study shall be conducted to assess the performance of Hybrid and Conventional Rice varieties in the Rice growing areas in Sindh.

Objectives

The main objectives of present study were

1. To find out socioeconomic factors of Hybrid and Conventional rice growers in Taluka Golarchi District Badin Sindh.
2. To determine production costs, physical productivity and net return of Hybrid and Conventional rice in study area.
3. To identify the issues and suggest the policy measures for sustainable Hybrid and Conventional Rice production

MATERIALS AND METHODS

The study was conducted through primary data collection from growers of Rice from Taluka Golarchi District Badin. The study focused on the determinants affecting Rice yield and to compare the financial gains from two Rice activities (Hybrid VS conventional Rice).

Study Area

The research work was conducted in Taluka Golarchi, districts Badin of Rice cropping zone of Sindh. The selection of growers has been carried out based on the criteria of adopter and non adopter of hybrid Rice. Primary data will be collected from sample of 60 hybrid and Conventional rice growers, which will equally be distributed among different categories of farmers will be selected by purposive sampling techniques from the farms located within 10-kilometers radius of Taluka Golarchi District Badin.

Data Collection

Information about Rice production and other necessary aspects was collected crop and operation wise, by employing comprehensive and pre tested questionnaire. In order to enhance the response rate, data was collected through interview .Although questionnaire was prepared in English language while the interview with respondents was done in local language i.e. Sindhi. Different features were covered in the questionnaire. **Data Source**

The data source of this study consists of primary sources. The primary data were collected from the Rice growers through the well structured pre-tested questionnaire. Data was collected during the crop year. With the questionnaire of growers, information was collected, about the comparative economic analysis of Hybrid V/S Conventional Rice Production.

Data Collection Procedure

The data were collected by two stage stratified random sampling, in the first stage, major districts of Hybrid and conventional Rice cropping zone were selected, and in the second stage the location was identified with the help of Agriculture Extension. From each location about 4-5 growers were randomly selected and interviewed. A total of 60 growers including 30 Hybrid Rice growers and 30 conventional Rice growers were determined as a sample size on 95% confidence level with a interval of 9.7 for prediction of 5000 grower's. The interview with growers was carried out personally, which allowed very detailed insights in crop growing in the target areas.

Questionnaire Development

In all statistical surveys questionnaires are considered as the medium for recording the information obtained in a standardized manner. Keeping in view the comparative analysis of the economics of Hybrid V/S conventional Rice production district of Sindh questionnaire was developed; Questionnaire included important questions to obtain information about comparative hybrid v/s conventional rice production along with other socio-economic characteristics of the farm house hold.

Data analysis

After completing the field work, the data were edited and transferred from the questionnaires into worksheet as a database file (SPSS). The variable names within the database file refer to the numbers of each question in the questionnaire. To compare the productivity of moth Hybrid and Conventional Rice through production cost analysis which is explained below.

Socio Economic Characteristics

The status of the sample respondents can be well described through socio economic characteristics. In this study, different indicators of respondent's socio economic features identified:

Family Size

Family size is an important socio-economic indicator that affects the agricultural activities. Family size means how many members are there in a household. Labour is mostly taken from farmer's family; therefore, household size has considerable impact on farming activities.

Farm Size

Land holding is another important indicator of production. Land holding means the total area where farming operations are performed. Three type of farmers are categorizes here: small farmers having land up to 12.5 acres, medium farmers having 12.5 to 25 acres and large farmers having more than 25 acres.

Education

Education is the most important factor contributing to the production. Education means schooling years completed by a person to acquire knowledge. Educated persons can make better decisions, can take calculated risk and can adopt better technology of production.

Farming Experience

The experience of the farmer influence the yield obtained. Farmers have faced many problems in past and they know how to cope with them.

Seed Rate

Appropriate seed usage is very important for optimum level of production. Quality and quantity of seed both have significant impact on production.

Fertilizers Use

Fertilizers have substantial impact on production. Adequate fertilizer use decision is very important for crop production. Excessive use of fertilizers has negative impact on production, pollutes the underground water as well as surface water and hence the environment. So the adequate level of fertilizer use is necessary for optimum level of production.

No. of Irrigations

Irrigation is very essential element to determine the crop yield. Without irrigation there is no considerable output can be obtained. There are two sources of irrigation; canal water irrigation is charged by the government at fixed rate (Muamla) and tub-well irrigation costs on hourly bases.

Hired Labour

Labour also accounted for larger productions and important indicator of yield. Many types of labour were used to perform farming activities but here permanent on farm labour is taken as determinant of the production of Rice.

Data Analysis Techniques

To determine the contributions of the important variables in the rice production process, the Cobb-Douglas form of production function was finally estimated because of the best fit of the sample data. After different trial runs, 6 variables were ultimately selected to explain the production of Hybrid rice and the Conventional rice farmers. Care was taken to avoid multi co linearity. The general model was specified comprehensively in such a way that it could explain adequately the production process of the Hybrid rice of both types of farmers. To explore the input-output relationship of Hybrid rice production, the selected Cobb-Douglas production model, in its stochastic form may be expressed as:

$Y= aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}U_1$

The Cobb-Douglas production function was linear zed by transforming it into the following double log or log linear form so that it could be solved by the least square method:

$\text{Log } Y = \text{Log } a + b_1 \text{ Log } X_1 + b_2\text{Log}X_2 + b_3\text{Log}X_3 + b_4\text{Log}X_4 + b_5\text{Log}X_5 + b_6\text{Log}X_6 + U_i$

Where,

Y = Return from rice (Rs./ha)

a = Constant or intercept of value

X_1 = Cost of human labour (Rs./ ha)

X_2 Cost of seeds (Rs./ha)

X_3 = Cost of fertilizer (Rs./ ha)

X_4 Cost of insecticides (Rs./ ha)

X_5= Cost of irrigation (Rs./ha)

X_6= Cost of power tiller (Rs./ ha)

U_i = Error term

Farm Costs Analysis

The farm cost analysis is based on hybrid and conventional Rice production. The results of this study will provide for the comparison of total costs and returns of hybrid Rice with conventional Rice. Total costs consist of expenditure from the profit and loss account (fixed costs and variable costs etc.). For the estimation and calculations, following procedure is adopted to examine the profitability of hybrid as well as conventional Rice.

Total revenue

Total revenue is the total money received from the sale of any given quantity of output. The total revenue is calculated by taking the price of the sale times the quantity sold.

Total revenue = price x physical productivity

Total costs

Total Cost is the sum of the fixed cost and total variable cost for any given level of production.

Total Cost fixed cost + total variable cost

Total fixed costs

Total fixed costs are the costs that do not change with the level of production. For example, water Charges, Govt. Land Taxes.

Total variable costs

Total variable costs are the costs that change in direct proportion to changes in volume. Variable costs can be avoided by not producing. For example, the cost of feed to feed animals is a variable cost. If the animal is not purchased, no feed costs are incurred, but the fixed costs of the livestock building are still incurred.

Profit

Profit is the excess of receipts over the spending of business during any period

Profit = gross income - expenses

Gross margin

A gross margin is calculated by taking variable costs away from the gross income earned from an enterprise. Gross margins are often reported on a per rupees basis for cropping enterprises.

Gross margin = returns –variable costs.

RESULTS

The general objective of study was to find out the yield gap of Hybrid and Conventional Rice crop. Hybrid and Conventional Rice were performed in study area. Most of the farmers focused to adopt Hybrid Rice; they get greater benefits from Hybrid Rice than Conventional Rice. Distribution of respondents with socio-economic variables and the influence of these socio-economic variables on the production of Hybrid and Conventional Rice are discussed here.

Age Respondent

Age is one of the important characteristics of the community. It reflects on the productivity of the population as it has it a bearing on the overall health situation within the community. In developing countries, aged members are more prone to diseases and thus are less productive. It has a bearing on the employment pattern, spatial mobility and quality of work done. Age plays a significant role in any kind of business, particularly in agriculture, because the use of child labour on the farms is quite high.

Table 1: Distributions of farmers according to their age group

Age Group	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Up to 35	10	33.33	07	23.33
36 to 45	07	23.33	09	30.00
Above 45	13	43.33	14	46.67
Total	30	100.00	30	100.00

Table -1 depicts that 33.33% Hybrid and 23.33% conventional Rice farmers were belonged to age group up 35 years, while about 23.33% Hybrid and 30.00% Conventional farmers belonged to age group 36-45 years. About 43.33% Hybrid and 46.67% Conventional farmers' belonged to age group above 45 years.

Education Level

Education is always considered as an important factor of understanding and learning skills. It is education which changes the behavior of human beings. Education changes moral character, thinking pattern and make learn how to talk and behave with other people. It helps in making the decisions on right direction.

Table 2: Distributions of the farmers according to their education level

Education Level	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Illiterate	07	23.33	14	46.67
Primary-middle	10	33.33	12	40.00
Matric	05	16.67	05	16.67
Collage-University	07	23.33	03	10.00
Total	30	100	30	100

Table -2 reveals that 23.33% Hybrid and 46.67% Conventional farmers were illiterate, while about 33.33% Hybrid, 40.00% of Conventional Rice farmers were Primary-middle level of education. The 16.667% farmers of Hybrid Rice, 16.67% farmers of Conventional Rice were matriculation. 23.33% Hybrid and only 10.00% of Conventional Rice farmers were have Collage-University education in the study area.

Family Sizes

In human context, a family is a group of people affiliated by consanguinity, affinity, or co-residence. In most societies it is the principal institution for the socialization of children. Anthropologists most classify family organization as matrilocal (a mother and her children); conjugal (a husband, his wife, and children; also called nuclear family).

Table 3: Distributions of the farmers according to their family members

Family Members	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Below 5	13	43.33	07	23.33
5-8	11	36.67	12	40.00
Above-8	06	20.00	11	36.67
Total	30	100	30	100

Table -3 shows that 43.33% Hybrid farmers, 23.33% Conventional Rice farmers had 5-6 family members, 36.67% Hybrid Rice farmers and 40.00% of Conventional Rice farmers had 7-8 family members, 20.00% Hybrid farmers, 36.67% Conventional Rice farmers had above 8 family members in the selected area.

Marital Status

Marital status is the condition of being married, unmarried, divorced or widowed. Marriage is a legal contract between people called spouses. In many cultures, marriage is formalized via a wedding ceremony. Widowed this category includes persons who have lost their legally-married spouse through death and who have not remarried. Divorced this category includes persons who have obtained a legal divorce and have not remarried. Single this category includes persons who have never married. It also includes persons whose marriage has been legally annulled who were single before the annulled marriage and who have not remarried.

Table 4: Distributions of respondents according to marital status

Marital Status	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Single	08	26.67	11	36.67
Married	19	63.33	17	56.67
Divorced	1	3.33	1	3.33
Widow	2	6.66	1	3.33
Total	30	100	30	100

Table -4 shows that in Hybrid there were 26.67% were single marital status, 63.33% were married marital status, and 3.33% were widow and 6.66% ware divorced. While in case of Conventional Rice farmers were 36.67% were single marital status, 56.67% were married marital status, and 3.33%were widow, and 3.33% were divorced

Family Type

Joint family set-up, the workload is shared among the members, often unequally. The roles of women are often restricted to housewives and this usually involves cooking, cleaning, and organizing for the entire family. They are also responsible in teaching the younger children their mother tongue, manners, and etiquette. Extended family defines a family that extends beyond the nuclear family, consisting of grandparents, aunts, uncles, and cousins all living nearby or in the same household. An example is a married couple that lives with either the husband or the wife's parents. The family changes from nuclear household to extended household. A single-family detached home, also called a single-detached dwelling or separate house is a free-standing residential building

Table 5: Distribution of respondents according to family type

Family Type	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Joint	11	36.67	14	46.66
Extended	03	10.00	05	16.66
Single	16	53.33	11	36.67
Total	30	100	30	100

Table -5 Shows that in Hybrid Rice there were 36.67% were joint family system, 10.00% were extended family type and 53.33% were single family type. While in case of Conventional Rice were 46.66% were joint family system, 16.66% were extended family type and 36.67% were single family type.

Farmer Status

A farmer is a person engaged in agriculture, raising living organisms for food or raw materials. A farmer might own the farmed land or might work as a laborer on land owned by others, but in advanced economies, a farmer is usually a farm owner, while employees of the farm are farm workers, farmhands, etc. A tenant farmer is one who resides on and farms land owned by a landlord. Tenant farming is an agricultural production system in which landowners contribute their land and often a measure of operating capital and management; while tenant farmers contribute their labor along with at times varying amounts of capital and management. The rights the tenant has over the land, the form, and measure of the payment varies across systems

Table 6: Distributions of respondents according to farmer status

Farmer status	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Owner	15	50.00	12	40.00
Tenant	8	26.66	11	36.66
Owner cum Tenant	7	23.33	7	23.33
Total	30	100	30	100

Table -6 Shows that Hybrid there were 50.00% were owner ship, 26.66% were tenant farmers and 23.33% were owner cum tenant respondents. While in case of Conventional 40.00% were owner ship, 36.66% were tenant farmers, and 23.33% were owner cum tenant respondents.

Farming Experience

Experience in cultivation of land is always count as an important tool. Farmers having experience of crop production are always regarded as an asset in the farmer's community.

Table 7: Distributions of the farmers according to their farming experience

Farming Experience(years)	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Up to 10	14	46.66	13	43.33
11-20	09	30.00	06	20.00
Above 20	07	23.33	11	36.66
Total	30	100	30	100

Table-7 reveals that 46.66% Hybrid farmers and 43.33% Conventional farmers had up to 10 years of farming experience, while 30.00% hybrid farmers and 20.00% Conventional farmers had 11-20 years farming experience. 23.33% Hybrid farmers and 36.66% Conventional farmers had above 20 years of farming experience.

Farm Size

A farm is an area of land, or, for aquaculture, lake, river or sea, including various structures, devoted primarily to the practice of producing and managing food (produce, grains, or livestock), fibers and, increasingly, fuel. It is the basic production facility in food production. In agriculture, the structure of production units can be classified on the basis of size of holdings, gross or net produce, value added, capital employed, gross or net worth of the enterprise etc.

Table 8: Distributions of respondents according to agricultural farm size (acres)

Farm Size	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Less 5 acres	04	13.33	08	26.66
5-8 acres	06	20.00	11	36.66
8-10 acres	11	36.66	07	23.33
Above 10 acres	09	30.00	04	13.33
Total	30	100.00%	30	100.00%

Table -8 shows that Hybrid there were 13.33% were less 5 acres, 20.00% were 5-8 acres, and 36.66% were 8-10 acres farm size and 30.00% were above 10 acres farm size while in case of Conventional 26.66% were less 5 acres, 36.66% were 5-8 acres, 23.33% were 8-10 acres farm size. Only 13.33% were above 10 acres farm size.

Information

Information, in its most restricted technical sense, is a sequence of symbols that can be interpreted as a message. Information can be recorded as signs, or transmitted as signals. Information is any kind of event that affects the state of a dynamic system.

Table 9: Distributions of the farmers according to their source of information

Source of information.	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Relatives	13	43.33	15	50.00
Media	03	10.00	04	13.33
Seed Dealer	09	30.00	08	26.33
Ext. Deptt:	05	16.66	03	10.00
Total	30	100.00	30	100.00

Table -9 shows that Hybrid there were 43.33% were getting information about Hybrid Rice from Relatives, 10.00% were from Media, 30.00% were from Seed dealer and 16.00% were getting information about Hybrid Rice from Extension Department while in case of Conventional 50.00% were getting information about conventional Rice from Relatives, 13.33% were from Media, 26.33% were from Seed Dealer. Only 10.00% were getting information about Conventional Rice from Extension Department.

Soil Type

During the survey soil type were recorded according to the farmer's own classifications and terminology. For example, clay soil was described as "cheeki" whereas clay-loam was described as "Bhari" and sandy-loam as "Halki" and sandy loam as "waryasi".

Table 10: Distributions of the farmers according to their farm Soil Types

Soil Type	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Sandy	01	3.33	02	6.66
Sandy loam	08	26.66	05	16.66
Loam	15	50.00	17	56.66
Clay	06	20.00	06	20.00
Total	30	100	30	100

Table -10 shows that the Soil types at Hybrid were 3.33% were Sandy, 26.66% Sandy loam, 50.00% were loamy and 20.00% were above Clay Soil while in case of Conventional 6.66% were Sandy, 16.66% were Sandy loam, 56.66% loam and 20.00% were Clay Soil in study area.

Irrigation Source

Growers used different sources of irrigations such as canal and Tube wells to provide irrigation. Tube well water is mostly used at the time of scarcity of canal water.

Table 11: Distributions of the farmers according to Irrigation Source

Irrigation Source	Hybrid Rice		Conventional Rice	
	No. Respondent	Percentage	No. Respondent	Percentage
Canal	30	100	30	100
Tube well	0	0.00	0	0.00
Canal + Tube well	0	0.00	0	0.00
Total	30	100	30	100

Table -11 Show that in Hybrid as well as in Conventional Rice all most 100 percent respondents were using canal water source of irrigation.

Rice Varieties

The Rice varieties are the most vital and important input for crop production, Quality seed is one of the ways to increase the productivity

Table 12: Percent Area under Different Rice Varieties in Study area

Hybrid Rice		Conventional Rice	
Varieties	Area Percentage	Varieties	Percent Area
Guard-53	26.72	IRRI	29.08
Pokraj-101	33.30	Ks-133	21.64
Pride	5.57	Shandar	16.67
Anmol	5.27	Supper	3.88
Mehrani	8.61	Suppree	0.00
Dhaga	2.58	Kianat	0.00
Shahnshah-1	9.34	Ks-282	28.72
Winner	8.36		
Total	100		100

Table -12 indicates that About 13 Rice varieties were cultivated by sample farmers in the study area during the year 2012. These cultivars were grouped as hybrid and conventional varieties. Area of varieties under cultivation from hybrid group were 26.72% of Guard-53, 33.30% Pokraj-101, 5.57% Pride, 5.27% Anmol, 8.61% Mehrani, 2.58% Dhaga, 9.34% Shahnshah-1 and8.36% Winner. The area of conventional varieties found on farmer's field were 29.08% area of IRRI, 21.64% Ks-282, 28.72% of Ks-133, 16.67% Shandar and 3.88% area of Supper varieties were cultivated. From the hybrid group, the most popular varieties planted were Guard-53, Pokraj-101 and Anmol. In conventional group, the popular varieties planted were IRRI, Ks-282, Ks-133.

Seed

The seed is the most vital and crucial input for crop production, one of the ways to increase the productivity without adding considerably to the extent of land now under cultivation by planting quality seed.

Table 13: Distributions of the farmers according to Seed Sources of Hybrid and conventional Rice

Seed Sources	Hybrid		Conventional.	
	No. Respondent	Percentage	No. Respondent	Percentage
Seed dealer	30	100.00	3	10.00
Extension dept	0	0.00	0	0.00
Co-Farmers	0	0.00	2	7.00
Progressive farmer	0	0.00	9	30.00
Researcher	0	0.00	2	8.00
Own	0	0.00	14	45.00
Total	30	100.00	30	100.00

Table -13 shows that the 100.00% hybrid growers purchased seed from seed dealers and in case of conventional rice farmers purchase seed 10.00% from seed dealer, 7.00% from co-farmers, 30.00% from Progressive farmers and 8.00% percent from Researcher, where as 45.00% of farmers use own saved seed of conventional Rice.

Land management

Land management is the first task for better crop production. A good land management is necessary for proper and rapid growth of the crop. Normally deep plowings are done half feet below the surface and sub soil. After plowing, land is left for few days to get air and sunlight.

Table 14: Land management Practices of Hybrid and conventional Rice

Management practices	Hybrid Rice		Conventional Rice	
	No.	Percentage	No.	Percentage
Deep plough	1	25.00	1	14.28
Disc Harrow	1	12.50	1	14.28
Goble	2	25.00	2	28.57
Cultivator	2	12.50	1	14.28
Leveler/blade	1	12.50	1	14.28
ploughing+Planking	1	12.50	1	14.28
Total	8	100	7	100
Seed rate Kg/Acre	5.76		19.39	

Table -14 shows that majority of the sample respondents prepared their land with Goble followed by cultivator, Rotavator, deep plough leveler and ploughing with planking. Incase of hybrid varieties 2 times plowed their land with cultivator followed by Goble 2 time, Disc Harrow 1 time, Leveler/blade 1 time, ploughing+Planking 1 time and deep plough 1 time. While in Conventional Rice varieties land plowed 1 time with cultivator followed by goble 2 times, deep plough 1 time, Disc Harrow 1 time, ploughing+Planking 1 time, and Cultivator 1 time were done

Planting Time

Planting time plays an important role in the growth and yield of any crop. During the survey it was noted that growers usually plant their crop earlier for getting better market prices. However, it was also reported that early crop is a risky one in terms of germination of seed. The growers usually decide the planting time for rapid and successful growth by monitoring the climatic conditions of the area.

Table 15: Distributions of the farmers according to planting Time of Hybrid and conventional Rice

Planting Time				
Month	Hybrid Rice		Conventional Rice	
	No.Respondent	Percentage	No.Respondent	Percentage
June	7	23.33	9	30.00
July	12	40.00	15	50.00
August	11	36.66	6	20.00
Total	30	100	30	100

Table -15 Shows that Hybrid Rice there were 23.33% respondents planted in month of June, 40.00% were in July and 36.66% were planted in month of August. While in case of Conventional Rice 30.00% respondents were planted in Month of June, 50.00% were in July and 20.00% of respondents were planted in month of August.

Planting Methods

Rice is usually planted as seedlings and then transplanted in to field. Some growers used direct seed drilling into the soil. Growers usually raised seedlings for 20 to 30 days.

Table 16: Distributions of the farmers according to planting methods of Hybrid and conventional Rice

Sowing Method				
	No.Respondent	Percentage	No. Respondent	Percentage
Transplanting	30	100.00	30	100.00
Drill sowing	0	0.00	0	0.00
Both	0	0.00	0	0.00
Total	30	100.00	30	100.00

Table-16 Shows that in-case of hybrid Rice overall, 100% farmers raised nursery and then transplanted to the field. Whereas in Conventional Rice same practices of sowing methods i.e transplanting was found 100%, so this method dominant in both hybrid as well conventional Rice crop

Total fixed costs

Total fixed costs are the costs that do not change with the level of production. For example, the cost of owning a building is incurred regardless of whether the building is empty, half full, or overflowing.

Table 17: Total Fixed Costs of Hybrid and conventional Rice

Total Fixed Costs (Rs/Acre)Per Acer	Hybrid Rice	Conventional Rice
Land Rent	18245	18245
Land tax	97	97
Water charge	207	207
Total	18549	18549

Table -17 shows that the total fixed cost was 22737 Rs/Acre in Hybrid Rice and total fixed cost was

21689 Rs/Acre in Conventional Rice. Total fixed cost includes Land Rent, Land tax, and water charges

Total Variable Costs

Total variable costs are the costs that change in direct proportion to changes in volume. Variable costs can be avoided by not producing. For example, the cost of feed to feed animals is a variable cost. If the animal is not purchased, no feed costs are incurred, but the fixed costs of the livestock building are still incurred**.** Total variable cost consists of costs that are zero when output is zero and vary as output increases (decreases). These costs relate to the cost incurred for the use of variable inputs. Variable costs includes costs of cultivation, costs of labour, cost on seed (seed price and seed treatment), costs of fertilizers, costs of intercultural practices, costs of irrigations, Weedicides and pesticides costs, cotton picking cost etc.

Table 18: Total variable costs of Hybrid and Conventional Rice

Costs	Hybrid Rice			Conventional Rice		
	Quantity	Price/Unit	Total (Rs/Acre)	Quantity	Price/Unit	Total
Ploughing	8	1208.18	9665.51	7	1104.21	7729.47
Seed (Kg)	5.76	807.38	4650.53	19.39	59.41	1152.07
Bed making No.	5	209.66	1048.34	6	235.29	1411.75
Sowing/ Transplanting (Man/day)	10	264.29	2517.33	11	228.37	2512.16
Fertilizers (Bags)	3	2642.91	7928.73	4	2445.25	9781.0
Weedicide	1	850.00	850.00	0.00	0.00	0.00
Micro nutrients (Zink, Boron) begs	2	1882.16	3764.12	3	1194.84	3584.52
Irrigations (No.)	21	0.00	0.00	25	0.00	0.00
Pesticides (No.)	3	838	2514	4.5	845	3802.5
Harvesting cost (man/day.)	11	308.6	3395.03	9	356.2	3205.72
Threshing Rs/Min	44	79.41	3509.57	48	56.74	2733.16
Packing	19	79.41	1477.82	19	56.74	1056.49
Transportation	16	79.41	1273.74	16	56.74	910.11
Commission	2.85	79.41	227.11	2	56.74	120.86
Load/unload	8	79.41	640.04	7	56.74	423.28
Total variable costs (Rs/Acre)	43461.87			38423.09		

Table -18 Shows that the total variable costs for Hybrid Rice were (43461.87 Rs.) while in conventional Rice the total variable costs ware (38423.09Rs/Acre).

Total revenue

Total revenue is the total money received from the sale of any given quantity of output. The total revenue is calculated by taking the price of the sale times the quantity sold. (Total revenue = price x quantity).

Table 19: Physical Productivity and Total Revenue of Hybrid and Conventional Rice

	Hybrid Rice	Conventional
Yield mds/ac	79.41	59.74
Price Rs/mds	981.72	992.25
Gross Revenue (Rs/acre)	77958.38	59277.02

Table -19 Overall high yield was obtained 79.41mds/acre from Hybrid Rice while 59.74mds/acre average obtained by conventional Rice. As for prices concerned, the Hybrid and Conventional Rice growers received Rs. 981.72/mds and Rs. 992.25/mds respectively. Total revenue of Rice production was calculated and found that hybrid Rice growers received Rs. 77958.38/acre, while conventional Rice growers Rs. 59277.02/acre.

Gross Margin and Net Return

The analysis of gross margin is derived from the difference between total revenue and total variable costs. Total variable costs are calculated from the summation of total labor costs and total factor cost. Net Return is the value that remains after all costs; it is calculated by Gross Revenue subtracted by total costs. (Net Return = Gross Revenue- total costs.)

Table 20: Gross Margin and Net Return of Hybrid and Conventional Varieties

	Hybrid	Conventional
Gross Revenue	77958.38	59277.02
Fixed Costs	18549	18549
Variable Cost	43461.87	38423.09
Total Cost	62010.87	56972.09
Net Return	11759.49	2304.93
Gross Margin	34496.51	20853.93
I/O	1 : 1.8	1 : 1.5

Table -20 shows that Rice growers in selected study area who cultivate Hybrid Rice obtained higher gross margin (Rs. 34496.51/acre), whereas gross margin of conventional Rice growers who seem to be lower (Rs. 20853.93/acre).

The Net Return of Rice production was calculated and found that Hybrid Rice growers received higher Net Return which was (11759.49 Rs/Acre), where as Net Return of Conventional Rice grower who seem to be lower (2304.93Rs/Acre).

DISCUSSION

Hybrid rice refers to the first-generation (F1) offspring of a cross of two genetically diverse parents that yields (performs) better than both parents due to manifestation of a biological phenomenon known as hybrid vigor or heterocyst. Hybrid rice typically displays heterocyst (or hybrid vigor) such that when it is grown under the same conditions as comparable high-yielding inbred rice varieties it can produce up to 30% more rice. High-yield crops, like hybrid rice, are one of the most important tools for combating world food crises (IRRI). Hybrid Rice was first commercially cultivated in China in 1976 and its area had been expanded to more than 13 million hectares by 1990, it proven to have 20% yield advantage over inbred rice in China (Yuan, 2004). During the last decade, Vietnam, India, Philippines, Bangladesh and United States have also started its commercial cultivation. All most all the hybrids produced more number of grains per panicle and higher 1000-grain weight. Yield advantage of the hybrids over the commercially grown rice variety ranges between 4.59-21.33% except RH-257 and GNY-40. These two hybrids were low yielder by 4.20 % and 14.95%, respectively, than the check variety. PHB-71 was found better than KS-282 in cooking. Level of resistance to major insect pests and diseases was also discussed Akram *et al*. (2007).

There was 14.14% increase in Hybrid Rice yield comparing with conventional Rice which gives additional income to poor farmers in District Badin. Study revealed that overall cost of land management and seed on Hybrid Rice was high as compared to on Conventional Rice due to more land management practices and high seed rate. The use of fertilizer is more in conventional Rice as compared to Hybrid Rice. Overall high yield was obtained 79.41mds/acre from Hybrid Rice as compared to 59.74mds/acre by Conventional Rice. Total revenue of Rice production was received by the Hybrid Rice growers Rs. 77958.38/acre and conventional growers Rs. 59277.02/acre. Study results further indicate that hybrid Rice growers obtained higher gross margin Rs. 34496.51/acre, as compared to conventional growers Rs. 20853.93/acre.

On an average higher yield was obtained in hybrid Rice 79.41 monds per acre (14.4% percent higher than conventional Rice) while and Conventional Rice yield was low only 59.74monds per acre. Price gained per mond was mostly same the same. Income gained per acre 77958.38 rupees, and income gained from Conventional Rice was 59277.02 rupees

Reports indicates that majority of the farmers focused for adoption of Hybrid Rice which was beneficial to the farmers in both production and profit. Farmers use less fertilizer for Hybrid as compared to Conventional Rice and earn greater profit due to greater production.

Majority of Farmers were reducing the Conventional Rice area and focusing for Hybrid Rice, because of Hybrid Rice gives better yield i.e 79.41monds/Acre as compared to Conventional Rice which was 59.74mds/acre. Farmers were saying that Hybrid Rice is profitable as it grown in late season, so majority of farmers prefer to grow Hybrid Rice in end of July and Whole month of August.

Result highlighted that some of the differences in production cost related to production of hybrid Rice, compared with the Conventional Rice were 43461.87 Rs/Acre and 38423.09 Rs/Acre. Major differences in hybrid rice production cost are related to higher seed prices, slightly higher land management costs. The major attraction of hybrid rice production is related to the higher yield potential of hybrid rice was 79.41ounds/Acre as compared to Conventional Rice was 59.74mounds/Acre. Market price of both was nearly same i.e 981.72Rs/mound for Hybrid Rice and 992.25Rs/mound for Conventional Rice. Hybrid rice production offers farmers an excellent aid in better managing production, gross margin and increase net returns, as well as reduces net return variability from year to year, to the farming operation.

CONCLUSSION AND SUGGESTION

This study was carried out to compare the economic of Hybrid and Conventional Rice based on the field survey in the Rice cropping zone of Sindh. The information was collected from selected Hybrid and Conventional Rice growers. The data was collected through personal interviews. Number of analytical techniques has been used to access comparative economic analysis of hybrid v/s conventional rice production i.e. farm cost analysis, Net Return analysis; gross margin analysis.

Major findings are the differences in production cost between hybrid and Conventional Rice, which were 43461.87 Rs/Acre of Hybrid and 38423.09 Rs/Acre of Conventional Rice. Major differences in hybrid rice production cost are related to higher seed prices, slightly higher land management costs. The result indicates that significant increase in out put of hybrid rice production is related to the higher yield potential of hybrid rice was 79.41ounds/Acre as compared to Conventional Rice was 59.74mounds/Acre while market price of both was nearly same i.e 981.72Rs/mound for Hybrid Rice and 992.25Rs/mound for Conventional Rice.

Present study clearly indicates that Hybrid Rice farmers were increasing farm yield and farm profit compared to Conventional Rice. Hybrid rice production offers farmers an excellent aid in better managing production, gross margin and increase net returns, as well as reduces net return variability from year to year, to the farming operation. Farmers were focusing to increase the Hybrid Rice area. Hybrid rice production opens opportunities for rural employment. However, the analysis shows that hybrids have contributed very minimally to the improvement of paddy yield.

Therefore, it is suggested that to adopt more and more Hybrid Rice, through which farmers should be increase the production, gross margin and increase net returns. By increasing Hybrid Rice production farmers were improve the living intended. Farmers were unaware of proper combination of inputs and sowing time they either underutilized the inputs or over utilized and sow seed either very early or lat of the season. For the promotion of Hybrid Rice following strategy should be adopted.

- There is a need for Rice research programs. The scientists should make efforts for the own Hybrid Rice varieties, because of Hybrid Seed was imported which is expensive for farmers.
- Improper and water shortage made disturbance in Rice production, Government should provide irrigation water in proper way and timely.
- Advising proper combination of inputs to the farmer and giving subsidy on the inputs will result in enhanced per acre yield of Rice.
- Rice Farmers can be enhanced by the adoption of Hybrid Rice.
- Government should provide subsidies on fertilizers and pesticides and other micro nutrients.
- Farmers face the marketing problems. Government should make adequate policies and farmers must be involved while making these agricultural policies.
- There is need of proper guide to farmers about Hybrid Rice so Government should provide and activate researchers and extension department for proper guideline of farmers.

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