



Economic Analysis of Hybrid Rice in Taluka Golarchi District Baddin Sindh, Pakistan

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Abstract: Rice is second food source after wheat and is an important foreign exchange earning commodity of Pakistan's economy, which gives about \$950 million annually. Pakistan grows rice including early and late maturing varieties, hybrid and conventional rice varieties which are considered as high quality rice varieties. The study was designed to conduct economic analysis of hybrid rice production; major findings of the study were financial gain from hybrid rice. Taluka Golarchi was selected for the present study because it is a hybrid rice cropping zone, primary data on hybrid rice was collected from the farmers through personal interviews with the help of specially designed questionnaire. Result shows that total costs per acre of hybrid rice were 65993.62Rs/Acre which were slightly high due to higher hybrid seed prices, slightly higher land management costs. On an average higher yield 78.88mons/acre was obtained from hybrid rice. The gross revenue was received as 85643.96Rs/Acre. Study results further indicate that hybrid rice growers obtained higher gross margin 38199.34Rs/Acre, which gives additional income to poor farmers in study Area. Therefore, gross revenue gained 85643.96Rs/Acre by hybrid rice. High profit was observed in hybrid rice. Most of the farmers focused to grow hybrid rice due to high yield advantage.

Keywords: Hybrid Rice, Total Costs, Gross Revenue, Gross Margin, Net Returns

1. Introduction

Rice is the staple food for more than half of the world's population. In Asia, more than 80% of the people live on rice, and their primary food security is entirely dependent on the volume of rice produced in this part of the world. However, rice production increases are now lagging behind population growth. Overall, the total global rice is declining

gradually even with the extensive use of the modern varieties such as high yielding and hybrid varieties. (Noonari, S, et al. 2015)

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, 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 abiotic stresses (Khush, 2005).

Rice is one of the important food crops in the world and ranks second in terms of area and production. It is the staple food for about 50 per cent of the population in Asia, where 90 per cent of the world's rice is grown and consumed. Asia's food security depends largely on the irrigated rice fields, which account for more than 75 per cent of the total rice production (Virk *et al.*, 2004)

It is an important food and cash crop and second staple food source of grain crop of Pakistan after wheat and major source of foreign exchange earnings after cotton. Rice accounts 3.1 percent of the value added in agriculture and 0.7 percent in GDP. During 2013-14 rice is cultivated on an area of 2789 thousand hectares, 20.8 percent higher than last year's area of 2309 thousand hectares. The production stood at 6798 thousand tonnes against the target of 6200 thousand shows a growth of 9.6 percent against the target (Economic Survey of Pakistan, 2013).

In Pakistan's economy rice is second food source after wheat and is an important foreign exchange earning commodity which gives 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 coarse 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 coarse 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).

Sustainable rice production based upon projection of rice production, consumption, demand and supply of fertilisers. Since sustainable yield of crop considerably depends on balanced application of both chemical and organic fertilisers in the field level, the research suggests for increased usage of organic fertilisers. (Basak . J . K *et al.* 2015)

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 International Rice Research Institute (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. 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 was successfully developed in China where about 50% rice area is now under it (Yuan, 1994). Hybrid rice in China produced a yield advantage of 1.0-1.5 t/ha (20-30%) over the conventionally bred varieties (Virmani, 1994).

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.* 2004).

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 great 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 cultivations. Therefore there is further need of study of hybrid rice, this study shall be conducted to assess the Economic Analysis of hybrid rice varieties in the rice growing areas in Sindh.

2. Objectives

1. To determine production costs, physical productivity and net return of hybrid rice.
2. To identify the issues and suggest the policy measures for sustainable hybrid rice.

3. Methodology

The study was conducted by primary data collection from growers of rice from Taluka Golarchi District Badin. The main focus of study was to determinants the affecting rice yield and financial gains from rice activities (hybrid rice). Primary data was collected from sample of 60 hybrid rice growers, farmers was selected by random sampling techniques in Taluka Golarchi District Badin. Selected hybrid rice growers were interviewed by well designed questionnaire to collect the data. To accomplish the objectives mentioned above the specific analytical techniques were used to analyse the data. The objectives of study was accomplished by the rapid rural survey method together baseline information on production of hybrid rice crop and by collecting cross section micro level data from the hybrid rice crop growers in Taluka Gorachi District Badin Sindh.

The analytical techniques such farm cost and production analysis based on hybrid rice production were used to found the result. The results of this study were provided total costs and returns of hybrid 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 rice.

$$\text{Average} = \sum X_i / n$$

$$\text{Percentage} = F / N \times 100$$

$$TC = TFC + TVC$$

$$TR = TPP \times P$$

$$NR = TR - TC$$

$$GM = TR - VC$$

TC=Total Cost

TFC=Total Fixed Cost

TVC=Total Variable Cost

TR=Total Returns

TC=Total Cost

GM=Gross margin

TR=Total return

VC=Variable costs

TPP=Total physical productivity

P=Price

4. Results

The general objective of study was to find out the yield of hybrid rice crop. Most of the farmers focused to cultivate hybrid rice; they get greater benefits from hybrid rice. Results further discussed as under.

4.1. Rice Varieties Planted by Sample Farms

The seed varieties are the most of the important input for crop production, Quality seed is the base to increase the productivity

Table 1. Percent Area under different hybrid rice varieties in study area.

VarietiesArea	Percentage
Guard-53	28.22
Pokraj-101	33.80
Pride	5.57
Anmol	5.27
Mehrani	6.61
Dhaga	3.48
Shahnshah-1	8.44
Winner	8.36

Table 1 indicates that About 8 hybrid rice varieties were cultivated by sample farmers in the study area. Area of varieties under cultivation of hybrid rice were 28.22% of Guard-53, 33.80% Pokraj-101, 5.57% Pride, 5.27% Anmol, 6.618% Mehrani, 3.48% Dhaga, 8.44% Shahnshah-1 and 8.36% Winner. The most popular varieties of hybrid rice were planted Pokraj-101, Guard-53 and Shahnshah-1.

4.2. 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 2. Land management practices.

Management practices	Numbers
Deep plough	1
Disc Harrow	1
Goble	2
Cultivator	2
Leveller/blade	1
ploughing+Planking	1
Total	8
Seed rate Kg/Acre	5.76

Table 2 shows that majority of the farmers prepared their land with Goble followed by cultivator, rotavator, deep plough leveler and ploughing with planking. For 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.

4.3. 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 noted that sowing early crop is a risk in terms of germination of seed and disease and insect pests attack. The growers usually decide the planting time for rapid and successful growth by monitoring the climatic conditions of the area.

Table 3. Planting time of hybrid rice.

Month	Number Respondent
June	14
July	24
August	22

Table 3 shows that there were 14 respondents planted in month of June, 24 were in July and 22 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 25 to 35 days. During this period the grower take care of the seedlings for their survival.

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Table 4. Planting Methods.

Sowing Method	Number of respondent
Transplanting	60
Drill sowing	0
Both	0

Table 4 shows that most of the farmers prefer to use transplanting method of sowing in study area.

4.5. 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 5. Total Fixed Costs of Hybrid Rice.

Total Fixed Costs	(Rs/Acre)
Land Rent	18245
Land tax	97
Water charge	207
Total	18549

Table 5 shows that the total fixed cost of hybrid rice was 18549Rs/Acre which includes Land Rent, Land tax, and water charges.

4.6. Total Variable Costs

Total variable costs are the costs that change in proportion to changes in volume. 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 (tube well irrigation also be included), Fungicides costs, Weedicides costs pesticides costs, micro nutrients (zinc, boron etc) rice harvesting cost etc.

Table 6. Total variable costs of Hybrid Rice.

Costs	Quantity	Price/Unit	Total	Rs/Acre
Ploughing	8	1508.18		12065.44
Seed (Kg)	5.76	1010.38		5819.88
Bed making No	5	209.66		1048.34
Sowing (Man/day)	10	264.29		2517.33
Fertilizers (Bags)	3	2642.91		7928.73
Weedicide	1	850.00		850.00
Zink, Boron (begs)	2	1882.16		3764.12
Irrigations (No.)	21	0.00		0.00
Pesticides (No.)	3	838.00		2514.00
Harvesting (M/day)	11	308.60		3395.57
Threshing Rs/Min	44	79.00		3509.57
Packing	19	79.41		1477.82
Transportation	16	79.41		1273.74
Commission	2.85	79.41		640.04
Load/unload	8	79.41		640.04
Total variable costs (Rs/Acre)				47444.62

Table 6 shows that the total variable costs for Hybrid rice were 47444.62 Rs/Acre. Cost of hybrid seed was high due to slightly high price.

4.7. Total Revenue

Total revenue is the total money received from the sell of output. The total revenue is calculated by taking the price multiplied by quantity sold.

(Total revenue = price x quantity) (Biz 2002).

Table 7. Total physical productivity and total revenue of hybrid rice.

Hybrid	Rice
Yield mds/acre	78.88
Price Rs/mds	1085.75
Gross Revenue (Rs/acre)	5643.96

Table 7 shows that overall high yields was obtained 78.88 mds/acre from hybrid rice. As for prices concerned, the hybrid rice growers received price as 1085.75 Rs/mds, and

the total revenue was obtained as 85643.96Rs/acre.

4.8. Gross Margin and Net Return

Gross margin is the difference between total revenue and total variable costs. Total variable costs are the sum of total labour 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 8. Gross Margin and Net Return of Hybrid Rice.

Hybrid	Rs/Acre
Gross Revenue	85643.96
Fixed Costs	18549.00
Variable Cost	47444.62
Net Return	19650.34
Gross Margin	38199.34
Total Cost	65993.62

Table 8 shows that hybrid Rice growers in selected study area were obtained higher gross margin 38199.34Rs/acre, the net return of hybrid rice production was calculated that hybrid rice growers received higher net return which were 19650.34 Rs/Acre.

5. Discussion

Better crop production depends upon soil structure, climatic condition, quality inputs, better crop management and favorable marketing system. It is, therefore, considered meaningful to have brief discussion of area and production levels of hybrid rice production in Sindh province of Pakistan, which is the rice cropping zone of Pakistan.

Study revealed that overall cost of land management and seed on hybrid rice was high due to more land management practices and high seed rate. The use of fertilizer is much more less in hybrid rice. Overall high yield was obtained 78.88mds/acre from hybrid rice, and the gross revenue was received as 85643.96Rs/acre. Study results further indicate that hybrid rice growers obtained higher gross margin 38199.34 Rs/acre. Therefore, income gained per acre 85643.96 rupees by hybrid rice.

Majority of Farmers were focusing to cultivate hybrid rice, because of it gives better yield, result highlighted that the cost of production of hybrid rice 47444.62 Rs/Acre which were little bit high. Major reasons of high cost were higher seed prices, slightly higher land management costs. The study compared with the study of Khushk et al. (2011) on performance of rice hybrid and other varieties shown as under.

Khushk et al. (2011) assess the performance of rice hybrid and other varieties planted in rice growing areas of Sindh and Balochistan during the year 2008-2009. The results revealed that average yield of hybrid rice was 195 mds/hectare, followed by IRRI-6 (151 mds/hectare), B-2000 (91 mds/hectare) and Rosi (94 mds/hectare). This indicates that the yield of hybrid rice was higher by 29 percent than the major variety IRRI-6. However, the growers received low

price by Rs. 8/mds for hybrid rice against IRRI-6 variety. The main reasons for low price were reported as poor grain quality i.e. high percentage of broken rice and variation in the grain size. This study concludes that overall growers earned more profit by cultivation of hybrid seed technology but there are some repercussions of this technology such as, growers have to buy costly seed every year and have to depend on seed companies. Additionally there is a loss of age-old knowledge and tradition of seed production that sustained rice farming from centuries.

6. Conclusion and Suggestion

This study was carried out to economic analysis of hybrid rice based on the field survey in the rice cropping zone of Sindh. The information was collected from selected hybrid rice growers. The data was collected through personal interviews. Number of analytical techniques has been used to access cost of production and production analysis of hybrid rice i.e. farm cost analysis, net return analysis; gross margin analysis.

Major findings were production cost of hybrid rice slightly high which was 47444.62Rs/Acre due to higher seed prices, slightly higher land management costs in hybrid rice. The result indicates that significant increase in output of hybrid rice production is related to the higher yield potential of hybrid rice was 78.88mds/Acre.

Present study clearly indicates that hybrid rice farmers were increasing farm yield and farm profit. 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 created opportunities for rural employment. However, the analysis shows that hybrids have contributed very minimally to the improvement of paddy yield. Therefore, it is concluded that growing hybrid rice is a better way, 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.

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