Journal of Resources Development and Management
ISSN 2422-8397 An International Peer-reviewed Journal
Vol.10, 2015

Estimating Productivity Gap and Contribution of Wheat Production in Sindh Pakistan

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Abstract
Shaheed Benazirabad farmers were divided into groups named high yield group, medium yield group and low yield group. The farmers applied an average of 45.27 kg, 45.82 kg and45.18 kg seed per acre respectively. Though, there is not a very large difference in average seed used by both farmer groups but the later used less quantity of wheat seed per acre to some extent. The impact of different factors on these groups was measured through multiple liner regression models. It was found that there exists a yield gap of 17.84 mounds per acre between high yield group and research station. The yield gap between medium and high group was 8.02 Mds per acre while the yield gap between medium group and low yield group was 5.93 Mds per acre. The standard error of estimates F-statics and R-square for high yield group was 0.0623, 2.470 and 0.398 respectively, for medium yield group 0.0314, 3.231 and 0.486 respectively and for low yield group 0.056, 1.342 and 0.345 respectively. The other objective of the study was to calculate the growth rate of wheat in District Shaheed Benazirabad Sindh. The exponential function was used to calculate the growth rate. It was found during study that the growth rate of wheat in Pakistan was 2.59%, 2.94% growth of wheat in Sindh and in District Shaheed Benazirabad was -1.17%, 9.75% respectively.
Keywords: Wheat, Productivity, yield gap, F-statics, R-square, Benazirabad, Pakistan.

1. Introduction

Wheat (Triticum aestivum L.*)* is a cereal grain, originally from the Levant region of the Near East and Ethiopian Highlands, but now cultivated worldwide. Pakistan is the 9th largest wheat producer country; accounting for 3.04% of the world's wheat production from an area of 3.57% of the world Food and Agriculture Organization (FAO), wheat is the leading food grain of Pakistan and being staple diet of the people. It occupies a central position in formulation of agriculture policies. It contributes 14.4% to the value added in agriculture and 3.1% to GDP. 85% of wheat production takes place under irrigation system (tube well, canals) and 15% of wheat production takes place under (rain fed barani) area in Pakistan. Wheat grain is a staple food used to make flour for leavened, flat and steamed breads, biscuits, cookies, cakes, breakfast cereal, pasta, noodles, couscous and for fermentation to make beer, other alcoholic beverages, or bio fuel. Wheat is planted to a limited extent as a forage crop for livestock. The whole grain can be milled to leave just the endosperm for white flour. The by-products of this are bran and germ. The whole grain is a concentrated source of vitamins, minerals, and protein, while the refined grain is mostly starch (DAWN, 2014).

Pakistan is undergoing many structural changes in its economy as it is shifting from agricultural to services sector. Despite these changes, agriculture is still the single largest sector of Pakistan's economy. Although the share of agriculture in the country's GDP is declining, still it contributes a big share of 21 percent in its GDP. Almost 45 percent population of Pakistan receives employment from this sector. Furthermore, the population living in rural areas of Pakistan accounts for more than two-thirds of its total population and 60 percent of this population is dependent on agriculture and its allied industries for their livelihood (GOP, 2013).

The 25-million-ton wheat production target set by the government for 2013 seems too close yet so far as agriculture experts expect production to clock in between 23 million and 24 million tons according to actual estimates on the ground – depicting that the country is going to miss the target by at least a million tons this year. With the expectations of missing the target for the fifth consecutive year, the fear of wheat shortage and high flour price is on, and this is expected to hit the country in December or early 2014.With an annual population growth of 2.5%, Pakistan's population had shown a growth of 12.5% in the last five years and for the same period the government has failed to achieve the stagnant wheat production targets. Keeping in mind the carried forward stock of 0.5 million tons, it will be tough for authorities to meet wheat demands for the whole year (TET, 2013).

The factors mentioned above, nevertheless, signify the broad scope for increasing yield at the farm level and also call for better management practices, appropriate application of the inputs at the suggest levels, and provision of improved extension services at the farm level.

In recent years, wheat yields have been increased in Pakistan after the introduction of high-yielding varieties. Fertilizers and pesticides use also leave a positive impact on productivity of wheat. Increase in total wheat production nationally is partly due to the increase in the area under wheat production. But with all this, there are still large yield gaps in the performance of the production of wheat. The energy crisis in the country increased costs of inputs and changing climatic conditions and the majority of farmers driven to bankruptcy due to this factor. Thus, it becomes necessary to increase the productivity of wheat to minimize these yield gaps and increase output per unit of input. Only in this case, farmers can be encouraged to grow more wheat, because at the current rate of population growth, the country will be in the need of wheat, even above, which is unfortunately not happening.

2. Objectives

1. To identify the trends of wheat production (or the growth rate) in the study area.
2. To estimate the yield gaps in wheat production in District Shaheed Benazirabad Sindh.
3. To decompose the contribution of various factors to yield gaps.
4. To identify the constraints in wheat production.

3. Methodology

The study was carried out by the use of primary data from the Productivity Gap and Contribution in Wheat Production. This chapter contains two major segments. The first segment includes sampling method and data collection while analysis of the data is described in second segment.

The samples were supposed to contain wheat farmers. A sample size of 60 respondents was selected. For data collection, Multi-stage random sampling technique was used to select villages and respondents. Villages (representing average conditions) were randomly selected from District Shaheed Benazirabad Sindh**.**

3.1. Data Collection

Primary data was collected through a well structured questionnaire to get the information related to the wheat crop production..

3.2. Final Survey

After pre-testing and making some improvements in the questionnaire, final survey was conducted in study area to obtain the required information from respondents. The respondents were selected randomly from each village.

3.3. Data Editing and Coding

After data collection, the questionnaires were properly checked to make sure that all the responses had been recorded accurately. Sequentially all questionnaires were numbered in a serial order. Collected data will be analyzed using the Statistical Package for Social Sciences (SPSS). Results obtained will be used for discussion and recommendations.

3.4. Yield Gap

The yield gap is commonly defined as yield potential minus average yields. This yield potential refers to the genetic maximum yield of a crop. Evans (1996) defines this yield potential as "the yield of a cultivar when grown in environments to which it is adapted, with nutrients and water non-limiting and with pests, diseases, weeds, lodging and other stresses effectively controlled".

3.5. Estimation of Yield Gaps

Index of yield gap refers to percentage of yield potential unrealized. This is calculated by the formula:

$$\text{Index of yield gap} = \frac{\text{Potential Yield} - \text{Actual Yield}}{\text{Potetntial Research Station Yield}} \times 100$$

Index of realized potential yield is defined as the percentage of yield potential achieved which is calculated as:

$$\text{Index of realized potential yield} = \frac{\text{Actual Yield}}{\text{Potetntial Reserch Station Yield}} \times 100$$

Therefore,

Index of Potential Realization = (100 – Index of yield gap)

3.6. Analysis of Primary Data

According to the requirement s of type perceived responses various numbers and values were assigned to the different categories of information to facilitate the analytical work.

The respondents were categories into three groups on the basis of their yield to find the yield variability across the farmers.

Forms of production function fitted to the data of three yielding groups include:

- Cobb – Douglas type production function
- Linear multiple regression function

The criteria of assessing the accuracy of the fitted function and for selection of the estimated equation include the following:

1. Confirmation and consistency with accepted theory and logic
2. The size of coefficient of multiple determinations (R^2)
3. Statistically significant "T" and "F" values

Finally a simple multiple regression function was found to the best on the basis of R- square, F-ratio, standers error of the equation and t –values of the coefficients.

3.7. Model

Yd = a +b1 (HS) +b2 (ST) +b3 (CT) +b4 (SR) +b5 (SM) +b6 (NI) +b7 (F) + b8 (FYM) +b9 (CHM)

3.8.1. Dependent Variable

Yd = Average yield

3.7.2.Independent variable

Hs = Farmers land holding size.
St = Sowing time of wheat
Ct = Number of cultivations per acre
Sr = Seed rate of wheat per acre
Sm = Sowing with drill/ broadcast
F = Application of fertilizer per acre.
Fm = Application of Farm yard Manure per acre
Chm = Chemical cost per acre

The results from linear multiple regressions are presented in next chapter.

3.8. Cost of Production

The farmers were categories into three groups on the basis of their per acre yield i.e. high, medium and low yield farmers. Then the cost of productions of wheat crop was computed for these groups. These costs of production were used to make a comparison between high, medium and low yield farmers.

4. Results

The general objective of study was to find out the yield gap of wheat crop. This chapter has been further divided into sections. The first section presents the yield gap. In second section, a socio-economic character is presented. The economics of wheat production is described in section three. In section four, Factors affecting the yield is presented. Constraints in production of wheat are presented in section five. In last section the growth rate of is presented.

4.1. Yield groups

Table 1: Number of farmers in different yield groups and their yield

Yield Group	No. Respondent	Percentage	Average Yield
High above 40 Mds/acre	33	55.00	40.16
Medium 30-40 Mds /acre	19	31.66	32.14
Low below 30 Mds /acre	08	13.33	26.21
Total	60	100	-

Table-1 it is evident from table that the farmers having wheat yield more than 40 mounds per acre placed in high yield group, the farmers having wheat yield less than 33 -40 mounds per acre in medium yield group and the farmers having wheat yield less than 30 mounds per acre were placed in low yield group. Out of 60 farmers, it was found that30 farmers belonged to high yield group, 19 belonged to medium yield group and 08 belonged to low yield group.

4.2. Age

Table 2: Distributions according to age of the respondents in the study area

Age	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percentage	No. Respondent	Percentage	No. Respondent	Percentage
Less 25	07	21.21	06	31.57	02	25.00
25-45	21	63.63	8	42.10	03	37.50
Above 45	05	15.55	05	26.31	03	37.50
Total	33	100.00	19	100.00	08	100.00

Table-2 it is evident from the table that respondents belonged to age group less than 25 years with an average age of 21.21%, 63.63% were in the age group of between 25 and 45 years. 15.55% were under the last age category of above 45 years. For the medium yield group, that respondents belonged to age group less than 25 years with an average age of 31.57%, 42.10%were in the age group of between 25 and 45 years. 26.31% were under the last age category of above 45 years. For the low yield group, that respondents belonged to age group less than 25 years with an average age of 25.00%, 37.50% were in the age group of between 25 and 45 years.

37.50% were under the last age category of above 45 years.

4.3.Family Size

Table 3: Distributions according to Family Size of the respondents in the study area

Family Size	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percentage	No. Respondent	Percentage	No. Respondent	Percentage
Less 5	06	18.18	04	21.05	01	12.50
5-8	11	33.33	07	36.84	02	25.00
8-10	07	21.21	05	26.31	03	37.50
Above 10	09	27.27	03	15.78	02	25.00
Total	33	100.00	19	100.00	08	100.00

Table-3 it is evident from the table that respondents belonged to high yield family group less than 5 years with an average family of 18.18%. 33.33%, 21.21% were in the family group of between 5 - 8 members and between 8-10 members. 27.27% were under the last family category of above 10 years. For the medium yield group, that respondent belonged to family group less than 5 years with an average family of 21.05%. 36.84%, 26.31% were in the family group of between 5 - 8 members and between 8-10 members. 15.78% were under the last family category of above 10 years. For the low yield group, those respondents belonged to family group less than 5 years with an average family of 12.50%. 25.00%, 37.50% were in the family group of between 5 - 8 members and between 8-10 members. 25.00% were above 10 years respectively.

4.4. Education .

Table 4: Distribution according to education of the respondents in the study area

Education level	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percentage	No. Respondent	Percentage	No. Respondent	Percentage
Illiterate	02	6.06	01	5.26	01	12.50
Primary	08	24.24	05	26.31	03	37.50
Middle/ Matric	14	42.42	09	47.36	03	37.50
Intermediate	04	12.12	03	21.05	01	12.50
Graduation/ Master	02	6.06	01	5.26	00	0.00
Total	33	100.00	19	100.00	08	100.00

Table-4 it is evident from the table that respondents belonged to high yield education group Illiterate with an average education of 6.06%. 24.24%, 42.42% were in the education group of primary level and middle/ matric level of education. 12.12% were the intermediate education. 6.06% were graduate/master. For the medium yield group, that respondent belonged to Illiterate with an average education of 5.26%. 26.31%, 47.36% were in the education group of primary level and middle/ matric level of education. 21.05% were the intermediate education. 5.26% were graduate/master. For the low yield group, those respondents belonged to Illiterate with an average education of 12.50%. 37.50%, 37.50% were in the education group of primary level and middle/ matric level of education. 12.50% were the intermediate education. 0.00% was graduate/master.

4.5.Marital Status

Table 5: Distributions according to marital status of the respondents in the study area

Marital Status	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
Single	8	24.24	5	26.31	2	25.00
Married	22	66.66	12	63.15	6	75.00
Divorced	1	3.03	1	5.26	0	0.00
Widow	2	6.06	0	0.00	1	12.50
Total	33	100.00	19	100.00	08	100.00

Table-5 shows that high yield farmer there were 24.24% single marital status, 66.66% were married marital status, and 3.03% were widow. 6.06% was divorced. And medium yield farmer were 26.31% single

marital status, 63.15% were married marital status, and 5.26% were widow. 0.00% was divorced. While in case of low yield farmer were 25.00% were single marital status. 75.00% were married marital status, and 0.00% was widow. Only 12.50%were divorced respectively.

4.6.Family Type

Table 6: Distributions according to family type of the respondents in the study area

Marital Status	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
Joint	19	57.57	12	63.15	5	62.50
Extended	4	12.12	3	15.78	2	25.00
Single	10	30.30	4	21.05	1	12.50
Total	33	100.00	19	100.00	08	100.00

Table-6 shows that high yield farmer there were 57.57% joint family system, 12.12% were extended family type and 30.30% were single family type. Medium yield farmer there were 63.15% joint family system, 15.78% were extended family type and 21.05% were single family type. Low yield farmer there were 62.50% joint family system, 25.00% were extended family type and 12.50% were single family type respectively.

4.7. Farming Experience

Table 7: Distribution according to farming experience of the respondents in the study area

Farming Experience year	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
1 - 10	2	6.06	2	10.52	0	0.00
11 - 20	4	12.12	1	5.26	1	12.50
21 - 30	12	36.36	8	42.10	3	37.50
31 - 40	9	27.27	4	21.05	2	25.00
Above 40	06	18.18	4	21.05	2	25.00
Total	33	100.00	19	100.00	08	100.00

Table-7 shows the farming experience of different categories of farmers. High yield group had 6.06% farmers of average experience of 1 – 10 years, 12.12% farmers of average experience of 11 – 20 years, 36.36% farmers of average experience of 21-30 years, 27.27% farmers of average experience of 31-40 years, 18.18% farmers of average experience of 31-40 years. Medium yield group had 10.52% farmers of average experience of 1 – 10 years, 5.26% farmers of average experience of 11 – 20 years, 42.10% farmers of average experience of 21-30 years, 21.05% farmers of average experience of 31-40 years, 21.05% farmers of average experience of 31-40 years. Low yield group had 0.00% farmers of average experience of 1 – 10 years, 12.50% farmers of average experience of 11 – 20 years, 37.50% farmers of average experience of 21-30 years, 25.00% farmers of average experience of 31-40 years, 25.00% farmers of average experience of 31-40 years respectively.

4.8.Area under Wheat Crop

Table 8: Distributions according area under wheat crop of the respondents in the study

Area Under Wheat Crop	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
Less than 2.5	07	21.21	06	31.57	02	25.00
2.5-5	21	63.63	8	42.10	03	37.50
Above 5	05	15.55	05	26.31	03	37.50
Total	33	100.00	19	100.00	08	100.00

Table-8 presents the wheat area sown by sample households for the wheat crop. High yield group had 21.21% farmers use area 2.5 acres, 63.63% farmers use area 2.5-5 acres, 15.55% farmers use area above 5 acres. Medium yield group had 21.21% farmers use area 2.5 acres, 63.63% farmers use area 2.5-5 acres, 15.55% farmers use area above 5 acres. Low yield group had 21.21% farmers use area 2.5 acres, 63.63% farmers use area 2.5-5 acres, 15.55% farmers use area above 5 acres respectively.

4.9. Number of Ploughs

Table 9: Number of Ploughs for Wheat Crop in the study area

Number of Ploughs	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
Less than 4	12	36.36	7	36.84	03	37.50
Above4	21	63.63	11	57.89	05	62.50
Total	33	100.00	19	100.00	08	100.00

Table-9 shows the number of ploughs given by different farmer groups for wheat crop. The high yield group had 36.36% of farmers giving less than 4 ploughs per acre. In the 4 & above number of ploughs there were 63.63% per acre on average. The medium yield group had 36.84% of farmers giving less than 4 ploughs per acre. In the 4 & above number of ploughs there were 57.89% per acre on average. The low yield group had 37.50% of farmers giving less than 4 ploughs per acre. In the 4 & above number of ploughs there were 62.50% per acre on average.

4.10. Seed

Table 10: Qualities of Seed and Seed Rate used for wheat crop in the study area

Qualities and Rate of Seed	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent%	No. Respondent	Percent
Certified	09	27.27	08	42.10	03	37.50
Own	24	72.72	11	57.89	05	62.50
Total	33	100.00	19	100.00	08	100.00
Seed Rate (kg/acre)	45.27 k.g		45.82 k.g		45.18 k.g	

Table-10 shows the quality of seed used by sample households. The high yield group had 27.27%of farmers used certified seeds. 72.72%of farmer use their own seeds for sowing wheat. The medium yield group had 42.10% of farmers used certified seeds. 57.89% of farmer use their own seeds for sowing wheat. The low yield group had 37.50%of farmers used certified seeds. 62.50%of farmer use their own seeds for sowing wheat. It is evident that farmers applied an average of 45.27 k.g kg, 45.82 k.g and45.18 k.g seed per acre respectively. Though, there is not a very large difference in average seed used by both farmer groups but the later used less quantity of wheat seed per acre to some extent.

4.11.Sowing Method

Table 11: Sowing method adopted by farmer in the study area

Sowing Method Adopted	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
Drill	19	57.57	8	42.10	03	37.50
Broadcast	14	42.42	11	57.89	05	62.50
Total	33	100.00	19	100.00	08	100.00

Table-11 shows that by which method the farmer groups cultivated wheat crop in the sample area. that a highest of 57.57% of high yield respondents cultivated wheat by drilling method, followed by 42.10%of medium yield group farmers who used this method for wheat sowing. Also, there were 37.50% of low yield group farmers who adopted to drill sowing for wheat. This accounts for 42.42% of high yield category, 57.89% of medium yield category farmers and 62.50% of low yield category.

4.12Number of Irrigations

Table 12: Numbers of irrigations applied by farmer in the study area

No. of irrigation applied	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	No. Respondent	Percent	No. Respondent	Percent	No. Respondent	Percent
One	0	-	0	-	0	-
Two	1	3.03	0	-	1	12.50
Three	7	21.21	7	36.84	5	62.50
Four	11	33.33	10	52.63	1	12.50
Five	15	45.45	2	10.52	1	12.50
Total	33	100.00	19	100.00	08	100.00

Table-12 shows the number of irrigation applied to one acre of wheat crop by different farmer groups. There were no farmers from all three groups who applying single irrigation only. The farmers who applied 2 irrigations only were from high and medium yield group 1 and 1 farmers respectively, but no farmer from medium yield group. High farmers applied 21.21% irrigations that included 62.50% low yield group and 36.84% medium yield group. Most of the farmers applied 4 irrigations to the wheat crop.

4.13Fertilizers

Table 13: Average quantity of fertilizers used for wheat crop in the study area

Fertilizers	High Yield Farmer High above 40 m/acre	Medium Yield Farmer Medium 30-40 m/acre	Low Yield Farmer Low below 30 m/acre
Urea	1.82	1.34	1.32
DAP	0.99	0.81	0.63
Others	0.37	0.16	0.11

Table-13 shows the average quantity of fertilizers used by different categories of farmers on wheat crop. According the results, the overall use of urea fertilizer by all farmer groups was an average of 1.59 bags per acre which is much lower than the recommended quantity. It was because of the increased cost of the fertilizers. Among the farmer groups, high yield group used the greatest quantity of average of 1.82 bags per acre, followed by the medium yield group who used slightly less quantity than first group. The low yield group used the lowest quantity of urea fertilizer with an average of 1.32 bags per acre. In the case of DAP fertilizer, again the high yield group used greatest quantity of DAP as their average for one acre is 0.99 bags per acre much closer to the recommended quantity of 1 bag per acre. Medium yield group farmers used exactly 0.81 bags of DAP per acre which is a bit less than the high yield group average. The low yield group again used the least quantity of DAP per acre, i.e. 0.63 bags per acre.

4.14.FYM

Table 14: Average Use of FYM for wheat crop in the study area

FYM	High Yield Farmer High above 40 m/acre	Medium Yield Farmer Medium 30-40 m/acre	Low Yield Farmer Low below 30 m/acre
Trolleys	0.79	0.42	0.21

Table-14 presents the use of FYM by farmer groups. High yield group of farmers, who used more FYM as their average is 0.79 trolleys per acre. After high yield group, there were medium yield group respondents who used an average of 0.42 trolleys of FYM per acre. Low yield group farmers used less of FYM which is 0.21 trolleys per acre, because they used for of urea and DAP. The results is due to the fact that high yield group farmers were mostly large farmers as compared to other group farmers, and therefore they also have higher number of livestock heads which generate FYM to be used in fields. The overall average of FYM used by all farmers was 0.63 trolleys per acre.

4.15. Average Cost of Wheat Production

Table 15: Average Cost of Wheat Production among different Farmer in the study area

Activities of Wheat Production	High Yield Farmer High above 40 m/acre		Medium Yield Farmer Medium 30-40 m/acre		Low Yield Farmer Low below 30 m/acre	
	Total cost of production	Percent (TCP)	Total cost of production	Percent (TCP)	Total cost of production	Percent (TCP)
Preparation	3023.02	12.17	3226.00	14.48	2892.1	13.95
Sowing	292.06	1.18	215.79	0.97	202.6	0.98
Seed	1576.19	6.35	1491.29	6.69	1335.4	6.44
Fertilizers	8986.83	36.19	6644.08	29.82	6046.0	29.17
Chemicals	1175.87	4.74	1165.00	5.23	528.9	2.55
Irrigation	3919.70	15.78	4256.18	19.10	5585.9	26.95
Harvesting	3773.77	15.20	3514.44	15.77	2992.18	14.43
Labor	2085.32	8.40	1769.08	7.94	1146.05	5.53
Total	24832.75	100.00	22281.86	100.00	20729.35	100.00

Table-15 average cost for land preparation which included ploughing and seed bed making cost was about Rs. 3066 per acre and it was 13.12 percent of total cost for wheat production. Cost for sowing operations, which included drilling cost, was only Rs. 416.3 and it is 1.7 percent of the total cost. Per acre average cost for seed was Rs 1511.19 and it was 6.46 percent of the total cost. Fertilizers accounted for a major proportion (33.28 percent) of total cost as it was an average of Rs. 7779.33 per acre. The average per acre cost for chemicals was Rs. 1070.00 and it was 4.58 percent of the total cost. Irrigation cost was the second major contributor to the total wheat production costs as it was Rs. 4290.07 per acre accounting for 18.35 percent of the total costs. The cost for harvesting operations includes the ripper cost, cost for manual cutting, the harvester costs and threshing costs. These costs accounted for 15.26 percent of the total wheat production cost and were as high as Rs. 3567.89 per acre on average. The cost for casual labor in wheat production is not much higher because most of the farmers were small and they used their own labor. It is evident from the Table that labor costs accounted for 7.86 percent of the total cost and it was Rs. 1836.46 per acre on average. The total per acre average cost for wheat production by all farmer groups in the sample area was Rs. 23375.26. Most of the farmers in the sample told that they experienced much higher cost this year than the previous ones because of the surge in fuel prices.

4.16.Crop Yield and Revenue

Table 16: Yield and Revenue of Wheat Crop in the study area

Item	High Yield Farmer High above 40 m/acre	Medium Yield Farmer Medium 30-40 m/acre	Low Yield Farmer Low below 30 m/acre
Yield ()	40.16	32.14	26.21
Price per mound	Rs.950	Rs.950	Rs.950
Wheat Chaff (Mds)	40.16	32.14	26.21
price per Mds	Rs.250	Rs.250	Rs.250
Revenue Rs.	48190.48	38558.89	31452.53

Table-16 presents the revenue of wheat production accrued to different farmer groups. The revenue was highest among high yield group as they had the greatest productivity of wheat per acre which was 40.16 Mds per acre (1 Mds = 40 kg). The productivity of medium yield group was highest after the high yield group as it was 32.14 Mds per acre. Low yield group had the lowest productivity in the sample and it was an average of 26.21 Mds per acre. There were no significant differences for wheat grain prices and wheat straw prices as they were almost the same for all farmer groups. The revenue of the high yield, medium yield and high yield group was Rs. 48190, Rs. 38558 and Rs. 31452 respectively.

4.17.Gross Margins for Wheat among Farmer Groups

Table 17: Gross Margins of Wheat Production among Farmer in the study area

Item	High Yield Farmer High above 40 m/acre	Medium Yield Farmer Medium 30-40 m/acre	Low Yield Farmer Low below 30 m/acre
Revenue	48190.47619	38557.89474	31452.63158
Cost	24832.75	22281.86	20729.35
Gross Margin	23357.72	16276.04	10723.28

Table-17 presents the results of gross margins accrued to different farmer groups. High yield group farmers had the highest per acre average gross margins of Rs. 23357 followed by the medium yield farmers who had the gross margin of Rs. 14250. Although per acre average cost of high yield group was also highest, yet their margins are highest because their yield is also highest. The low yield group farmers experienced the lowest gross margin of Rs.

4.18.Regression Analysis for High Yield Group

Table 18: Summary Statics for High Yield Group

Variables	Coefficients(Bs)	Std. Error	T-test	**Significance**
Constant	3.114	0.582	5.354	0.000
Holding size	0.019	0.023	0.834	0.415
Sowing time	0.014	0.030	0.671	0.511
No. of cultivations	0.090	0.054	1.69	0.0472
Seed rate	0.255	0.131	1.946	0.028
Sowing method	-0.00698	0.025	-0.276	0.786
No. of irrigation	0.024	0.053	0.527	0.0478
Fertilizer nutrients	0.019	0.051	0.377	0.032
FYM	0.0357	0.045	0.790	0.439
chemical cost	0.00215	0.011	0.198	0.005

Table-18 the value of R^2 was 0.398 while adjusted R^2 was 0.223 while the value of F-test was 2.470, which is significant the 0.043 level of significance the regression Cob-Douglas equation is developed as under:

LnY = 3.114 + 0.019 X1+ 0.014 X2 + 0.090 X3 + 0.255 X4 - 0.0069 X5 + 0.0224 X6 + 0.019 X7 + 0.0357 X + 0.00215X9

4.19. Regression Analysis for Medium Yield Group

Table 19: Summary Statics for Medium Yield Group

Variables	**Coefficients (Bs)**	**Std. Error**	**T-test**	**Significance**
Constant	3.630	0.404	8.987	0.000
Holding size	0.0028	0.008	0.369	0.717
Sowing time	0.00567	0.008	0.667	0.513
No. of cultivations	0.0585	0.043	1.36	0.092
Seed rate	0.0847	0.051	1.66	0.048
Sowing method	-0.00697	0.014	-0.508	0.617
irrigation	0.0532	0.029	1.83	0.029
Fertilizer nutrients	0.0427	0.030	1.423	0.064
FYM	0.0114	0.031	0.371	0.715
Chemical Cost	0.0736	0.034	2.14	0.031

Table-19 the value of R2 was 0.486 while adjusted R2 was 0.361 while the value of F-test was 3.231 which are significant the 0.021 level of significance. The regression Cob-Douglas equation is developed as under:

LnY = 30630 + 0.0028 X1 + 0.00567 X2 + 0.0585 X3 + 0.0847 X4 - 0.00697 X5 +0.0532 X6 + 0.0427 X7 + 0.0114X 8 + 0.0736X9

4.20.Regression Analysis for Low Yield Group

Table 20: Summary Statics for low Yield Group

Variables	**Coefficients (Bs)**	**Std. Error**	**T-test**	**Significance**
Constant	3.006	0.405	7.427	0.000
Holding size	0.00290	0.018	0.163	0.872
Sowing time	-0.0161	0.014	-1.140	0.269
No. of cultivations	0.0656	0.059	1.11	0.153
Seed rate	0.184	0.106	1.73	0.043
Sowing Method	-0.00320	0.030	-0.107	0.916
No. of Irrigation	0.0765	0.043	1.77	0.038
Fertilizer Nutrients	0.185	0.047	3.97	0.000
FYM	0.0634	0.057	1.104	0.283
Chemical cost Cost	0.0124	0.010	1.24	0.114

Table-20 the value of R2 was 0.414 while adjusted R2 was 0.345 while the value of F-test was 1.342

which is significant the 0.27 level of significance. The regression Cob-Douglas equation is developed as under:
LnY= 3.006 + 0.0029 X1 - 0.0161 X2 + 0.0656 X3 + 0.184 X4 - 0.0032 X5 + 0.0765 X6 + 0.0353 X7 - 0.0634 X8+0.0124 X9

6. Discussions and suggestions

The research study on Estimating productivity gap and contribution in wheat production: A case study of district Shaheed Benazirabad) Sindh was concluded for the findings during study were the most efficient to cultivate the wheat at remunerative level. The agricultural infrastructure is the web of personal, economic, social and legal relationships that support the production of agricultural commodities. It includes, most visibly, agricultural input suppliers and output processors. However, it also includes the formal and informal business relationships between individual farms. Infrastructure provides access to input and output markets, access to agricultural services ranging from continuing education to consulting, as well as including institutional arrangements, such as the legal and monetary systems. The efficient wheat crop production practices and issues in the production process for policy making.

Main conclusions of the study are as follows:

- It is concluded that high yield group is more specialized in terms of wheat crop production as compared to medium and low yield groups.
- It is concluded that fertilizer have a positive impact on yield but the farmers getting low yield were using very less amount of fertilizer because of its high prices.
- Different factors such as holding size, education, farming experience and farm machinery had positive impact on wheat production or productivity.
- Education affects the planning and managerial abilities of farmers in different farm operations. It is concluded that highly educated farmers get more wheat yield as compared to less educated.
- It is concluded that most of farmers belonged to high yield group were large farmers with holding size more than 25 acres.
- It s concluded that farmers having latest farm machinery getting high yield as compared to those which were less mechanized.
- It is evident from results that farmers in study area were paying high input prices and getting low output price. Therefore government should take part in the improvement of input-output price relationship.
- Government should check the proper management of input supply to avoid shortage and black marketing of different farm inputs.
- It is evident from regression results that farm machinery had positive impact on farm diversification. Therefore, government should initiate different schemes to provide tractors and other farm implements to farmers at cheaper rates.
- Task for researchers to evolve improved varieties of wheat with more yield potential.
- The results show that only 35 percent farmers of the study area had contact with agriculture officer. There should be the proper functioning of Extension Department to create a link between farmers and research station.
- The government should take part in the motivation of farmers towards the adoption of modern agricultural technologies.
- It is evident from the survey that the quality of canal water available for irrigation in study area was very less and timely availability was also a problem. Government should improve the canal system and assure the timely supply of canal water.
- There is a need to develop new and high yielding wheat varieties to reduce yield gap and government should check the performance of breeding departments and also ensure the access of these varieties to farmers.

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