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Impact of Wheat Breeding Research on Punjab Economy

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Abstract
With the rapidly growing population of Pakistan there is emerging need of food to keep pace with it. Different research institutions are working for it. The current study was launched to see the impact of current wheat breeding programs impact on Punjab economy. For this secondary data from crop reporting services was taken. Only for the years of 2000-2006 the complete set of data regarding variety area and production was available. Results revealed that among all the major factors contributing towards yield improvement, the Varity role was about 12 percent. It was great contribution of wheat breeding.

1. Introduction:

Wheat is the staple food of people in Pakistan and is grown over 6.39 million hectares in the Punjab province. It is the largest crop in terms of its size. Its share is 72.20% of all cereals and pulses in the country. The food security, therefore, squarely depends on its availability. Because of its stake in food security it is equally cultivated by small and large farmers and occupies more than 50% of the total cultivated area in the province. The relative contribution of wheat and its economic value is given in the table I. Wheat is thus a sound crop because of its large acreage and its large demand that out-stripes the demand of other crops together.

Table 1.Wheat contribution in Punjab agricultural economy in the year 2006-07

Crop Statistics	Pakistan	Punjab	% share
Area (Million hectares)	8.43	6.39	76
Production (M. Tons)	23.00	17.88	78
Yield (Tons/Hectare)	2.72	2.79	

Source: Agri-statistics of Pakistan 2006

Wheat has been grown since pre-historic time in this part of the world and is well anchored in our economy. It faces minimum competition and ensures its growers safer returns. Wheat faces few threats. The occurrence of its dreadful diseases "rusts" is under check due to deployment of resistant varieties and its yield is on increase. Since inception of the country wheat acreage, yield and production have seen 115, 172 and of wheat 484 percent increase, respectively. The gains in wheat production, however, are eliminated as fast as they occur. The rapid increase in population does off-sets the gains in production.

Wheat is the staple food and major items of the dietary schedule of the country population. Its availability is most essential for political and economical stability in the country. With the increase in the country population, the research efforts have to remain the prime. The
wheat yield have to be increased to meet the provincial and National obligations and at the same time, a size able area can be released for growing oil seed and pulses that are deficient is the country. It has been estimated that an average increase of 4 percent over the period is needed to meet the future demand.

1.1 Study Objectives:

1. To study the existing production status of wheat crop in the Punjab
2. To study the wheat varieties released by the wheat research institute, Faisalabad for the last 5 years.
3. To estimate the benefits generated by the wheat breeding research of Ayub Agricultural Research Institute.
4. To formulate the recommendation based upon the study findings for the development of the economy

2. Review of literature:

(Mahwish et al (2011): A vast study observed that there has been significant increase in growth after implementing the mutation breeding technology. There were twenty four new crop varieties produced resulted in positive impact on farmer's income and overall field growth. This research was based on purely secondary data published by different agricultural organizations in Pakistan. These organizations were working in the field of implementing and exploring new agriculture technology trends to gain more yield and profit.**)**

Campbell & Shebeski (1986)): Wheat breeding was launched in Canada in 1986 with the establishment of the Federal Experiment Farm System in Ottawa. A cross-breeding program in wheat was initiated two years later and almost twelve years later the new cultivar Marquis was developed from the cross

between Red Fife and Hard Red Calcutta and distributed to Canadian farmers in 1909. This cultivar quickly replaced Red Fife and became the dominant variety grown in the Prairie Provinces

Mohammadi and Haghparast (2011: The final stage of any crop breeding program m is to evaluate the promising genotypes, which have been already selected in research stations, in farmers' fields. This study was conducted to examine the superiority of 11 promising durum and bread wheat experimental lines against three farmers' cultivars across five testing sites in 2006-07 cropping season in western Iran. In framers' fields stability and genotypic superiority for grain yield were determined using genotype and genotype × environment (GGE) biplot analysis.

Blanche SB, Myers GO (2006): Discriminating ability refers to a location's ability to maximize the variance among genotypes in a study). Representativeness suggested that allocation is representative of the conditions of other locations included in the study. An ideal testing location combines both of these traits for the development of generally adapted plant materials.

3. Methodology

The aim of this study was to work out the economic impact of wheat breeding being conducted at AARI Faisalabad. For this purpose this important study was initiated. For this purpose data of wheat varieties from the year, 2000-2001 to 2005-2006 was taken from the Crop Reporting Services, Lahore. In order to work out the economic impact of wheat breeding there are some problems which are encountered in this process. Morris and Heisey (2003) recently reviewed the theoretical and practical challenges involved in estimating the benefits of plant breeding programs. They classified into three categories the problems encountered in most empirical studies

3.1Problems associated with measuring adoption of modern varieties

The first set of problems affecting efforts to estimate the benefits of plant breeding programs relates to measuring the area planted to modern varieties. This includes difficulties in defining exactly what constitutes a modern variety and in knowing the area planted to modern varieties. So it was decided that the varieties released by the wheat research institute in the last 15 years will be the modern varieties and area under these varieties will be the area under modern varieties. To maintain such data, it is a difficult job and there was only one organization that was maintaining such information. It was the Crop Reporting Services at Lahore which provided such information. So data regarding varietal distribution was collected from this secondary source.

3.2 Problems related to evaluating benefits associated with adoption

The second set of problems affecting efforts to estimate the benefits of plant breeding programs relates to the difficulty of evaluating the benefits associated with adoption of modern varieties. They include difficulties in: (a) measuring farm-level yield gains; (b) distinguishing between yield gains attributable to the adoption of modern varieties and those attributable to accompanying changes in crop management practices; (c) accounting for non yield benefits; (d) distinguishing between increases in yield potential versus maintaining current yields; (e) imagining counterfactual scenarios (i.e., what would have happened in the absence of the evaluated breeding program); (f) modeling aggregate price effects; and (g) accounting for policy distortions.

3.3 Conceptual Framework for estimating the Benefits Wheat Breeding Research

The gross annual benefits generated by wheat breeding research were estimated by using a simple economic surplus model:

$$\mathbf{B_t = A_t\ Y_t\ P_t}$$

Where:

$\mathbf{B_t}$ = value of additional production attributable to wheat improvement research in time t
$\mathbf{A_t}$ = area planted to modern wheat varieties in time t
$\mathbf{Y_t}$ = net yield gain attributable to wheat improvement research and
$\mathbf{P_t}$ = price of wheat grain at time t

Given that many of the assumptions needed to overcome the problems described earlier are implicitly embedded in the choice of the economic surplus model and in the parameter values used in estimating the model, it seems useful to briefly discuss each parameter.

3.4Value of additional production attributable to wheat improvement research (B)

The simple economic surplus approach used here focuses on a rather narrow measure of benefits—namely, the value of the additional grain production attributable to wheat improvement research. This measure fails to capture at least two important additional benefits that may also be attributable to wheat breeding efforts:

3.5 Non-yield benefits

Benefits that do not show up in the form of increased grain yields include improved grain quality, improved fodder and straw quality and quantity, and reduced crop growth cycles. Non-yield benefits can be very important; sometimes they actually exceed the value of yield benefits.

3.6 Improved host plant resistance to biotic and a biotic stresses

Modern wheat breeding programs seek to increase yield potential, but they also conduct "maintenance breeding"

with the goal of improving host plant resistance to biotic and abiotic stresses, such as diseases, insects, moisture extremes, temperature, and soil conditions. Successful maintenance breeding allows modern varieties to avoid yield losses due to stresses, so the benefits—yield losses foregone—are essentially non-observable

3.7 Description of the Model variables:

3.7.1 Area planted to modern wheat varieties (A)

Because wheat is a self-pollinating species, wheat varieties retain their essential genetic identity even when farmers replant farm-saved seed for many generations. This means that it is usually quite easy to determine the identity of wheat varieties being grown in farmers' fields (the same cannot be said of open-pollinating species such as maize). The area planted to modern wheat varieties was taken from the CRS Lahore for the years 2000-01 to 2005-06.

3.7.2Net yield gain attributable to wheat improvement research (Y)

Undoubtedly the single biggest challenge in estimating the benefits of wheat breeding research is the determination of a credible estimate of the average annual yield gain attributable to wheat breeding efforts. Because of the difficulty of estimating yield gains realized in farmers' fields, a model was estimated using four different values for the cumulative yield gain attributed to adoption and/or replacement of modern varieties. Under the most conservative scenario, the yield gain was assumed to be 0.15 t/ha. Under the most liberal scenario, the yield gain was assumed to be 0.45 t/ha. Intermediate scenarios were also calculated assuming yield gains of 0.25 t/ha and 0.35 t/ha. Yield gains of this magnitude have been used in many previous studies that have estimated the benefits from wheat breeding efforts. Heisey, Lantican, and Dubin (2002) assumed yield gains ranging from 0.2 to 0.4 t/ha. Evenson (2000) used a figure of about 0.45 t/ha/year in his conservative estimate (intended to show the benefits of CIMMYTs wheat breeding program alone). Maredia and Byerlee (1999) calculated that CIMMYT crosses show an advantage of about 0.25 t/ha over other entries in International Spring Wheat Yield Nursery (ISWYN) trials. Byerlee and Traxler (1995) came up with the figure of about 0.35 t/ha in estimating the yield gains observed in CIMMYT-bred spring bread wheat varieties. However in the current study the yield gain of 0 .3 tons/ha due to variety only, was used for the estimation of benefits for wheat breeding at AARI.

4. Results and Discussion

Table-2: The varieties evolved by the wheat Research Institute, Faisalabad and its impact on Punjab economy.

AARI Varieties

S.No.	Particulars	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
1	Wheat area in Punjab (000 Hect.)	6255.5	6101.8	6097.3	6255.5	6378.9	6483.9
2	Punjab production (000 Tons)	15419.00	14594.40	15355.00	15639.00	17375.00	16776.00
3	Area under variety (000Hect.)	6186.7	6089.6	6061.3	6249.4	6347.4	6444.5
4	Percent area under variety	98.90	99.80	99.40	99.90	99.50	99.40
5	Average Yield gain factor due to variety (Ton/Hect.)	0.30	0.30	0.30	0.30	0.30	0.30
6	Additional gain in yield due to variety Punjab/annum (Tons)	1856010	1826880	1818390	1874820	1904220	1933350
7	Price of wheat /Ton	7500	7500	7500	8750	10000	10375
8	Additional gain in Value of wheat /annum (Rs. Million)	13920	13702	13638	16405	19042	20059
9	Economic worth of Punjab wheat production (Rs. Million)	115643	109458	115163	136841	173750	174051
10	Percent share of variety in economic worth	12.04	12.52	11.84	11.99	10.96	11.52

4.1 Aggregate analysis:

The economic benefit due to the introduction of wheat varieties of the AARI has been based upon the data provided by the crop reporting services, Lahore. The area under different wheat varieties remained cultivated during the crop year 2000-01 through 2005-06 in the Punjab along with total wheat area and production figure has been analyzed using grain yield surplus technique as applied by the CYMMIT Mexico International wheat breeding program evaluation. The results so derived are discussed here under to understand the benefit so added toward the Punjab economy by the wheat breeding research of AARI, on annual basis.

During the year 2000-01 the area under wheat crop remained to about 6255.5 thousand hectare with production of 15419 thousand tones in the Punjab province, whereas, the area covered by the AARI, wheat varieties reported by the crop reporting services was about 6186.7 thousand hectare that came to about 98.90

percent of total area of wheat in the Punjab. The analysis of the data made under variety gain factor technique indicated that some 1856010 tones of additional grain yield were obtained due to these varieties injection. The economic value of this additional produced wheat rated at Rs.7500/- tones came to 13920 million of rupee that the wheat breeding program has added as benefit to the Punjab economy during the crop year 2000-01.The total economic of worth the wheat produced during the same year value at same rate remained to 115643 million and these benefit were of the 12.04 percent of value of wheat so produced in the province.

Visualizing the 2001-2002 crop year, some 6256.5 thousand hectare area with production of 14594.40 thousand tons of wheat was reported by the Punjab bureau of statistics. The crop area under different wheat varieties of the AARI as reported by the crop reporting services, Lahore, was about 6089.6 thousand hectare that is 99.80 percent of the total wheat area of the province. The additional gain yield thus came to some 1826880 tons of wheat. The value of this additional grain yield so obtained due to the breeding research amounted to Rs.13920 million added to the Punjab economy during the crop year under analysis.

In the crop year 2002-03, the wheat area statistics were around 6097.3 thousand hectare with production of 15355 thousand tons of wheat grain, whereas, the AARI wheat varieties remained covering the 99.40 of the total wheat area of the Province. The economic benefit added due to the varietals gain factor were of the amount of Rs.13638 million to the Punjab economy during the crop year 2002-03.

Analyzing the crop data of year 2003-04 and 2004-05, the benefit so added due to this varietals improvement were of the tune of 16405 million and 19042 million of rupee for the Punjab economy gained in the respective crop years.

The wheat crop area in the year, 2005-06 remained about 6483.9 thousand hectare with production of some 16776 thousand tones in the Punjab. The area under the AARI, released wheat varieties reported was 6444.50 thousand hectare that was about 99.40 percent of the total cultivated wheat in the Province. The additional grain produced estimate through the varietals injection thus came to 1933350 tones. The additional yield rated at Rs.10375/tones amounts to about 20059 million of rupee, the benefit that have added to the Punjab economy by the wheat breeding research of AARI during the year 2005-06. The detail of the area, production and related data with source has been presented on table-2.

5. Recommendations

- The Government should allocate funds according to the share of the crop in the cropping system.
- The study analysis needs its revision over time and on the zone basis for better understanding the genetic viability of the varietial performance in different ecological zones of the Punjab.
- The data is generated from the farmers of the Punjab; the majority of those are illirate. Some more information alongwith the source is needed for authentication of the results.
- Some joint collaboration of the breeders, planners, crop reporting department and social scientists are needed to rape the benefit of the study. The data availability of the wheat varietal existence in the other. Provinces of the country or neighbor country should also be collected by the Crop Reporting Services.

6.Literature Cited

1. Bhatia, C.R., Nichterlein, K., Maluszynski, M., & Van Zanten, L. (1999). Grain Legume Cultivars Developed From Induced Mutation and Mutations Altering Fatty Acid Composition
2. Bhatia, C.R., Nichterlein, K., & Maluszynski, M. (1999). Oilseed Cultivars Developed From Induced Mutaion and Mutations Altering Fatty Acid Composition. Plant Breeding and Genetics
3. Blanche SB, Myers GO (2006) Identifying discriminating locations for cultivar selection in Louisiana. Crop Science 46, 946-949
4. Campbell, A.B., Shebeski, L. 1986. “Wheat in Canada - Past and Present”. In “Wheat production in Canada: a Review” edited by A.E. Slinkard, D.B. Fowler, University of Saskatchewan, Saskatoon, Canada: Division of Extension and Community Relations
5. Mahwish et al 2011:European Journal of Scientific Research ISSN 1450-216X Vol.52 No.3 (2011), pp.287-294 © EuroJournals Publishing, Inc. 2011
6. Mohammadi and Haghparast (2011): International Journal of Plant Breeding ©2011 Global Science Books
7. Section, Joint FAO-IAEA Division, Vienna, Austria.

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