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Full Length Research Paper

Evaluation of key factors responsible for agricultural growth and development in Pakistan

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Agricultural productivity growth is vital for stimulating growth in all parts of the economy. Importance of this sector cannot be denied as it feeds people, used as a base for foreign trade and provides raw material for industry. Due to its enormous importance to national economy, high priority should be given to raise agricultural productivity and farm's income. The objective of this study was to find out the key factors contributing towards agricultural growth in Pakistan. For this purpose, the study examined the impact of total cropped area, irrigation water, agricultural credit, import of pesticide and improved seed distribution on growth in Agricultural GDP (AGDP) for the period of 1970 to 2009. Total cropped area, irrigation water, improved seed distribution and import of pesticides have significant effects on the growth of AGDP. The long-run relationship between the Agricultural GDP and the total cropped area (million hectares) was positive for the Pakistani economy. The short run elasticity of the total cropped area with respect to AGDP was 0.47 and long run elasticity was 2.13. Thus, 1% increase in the total cropped area on average could enhance AGDP by 0.47% in the short run and 2.13% in the long run. Irrigation water has very critical position in farm production; 1% increase in availability of water on average boosted the AGDP by 0.93% in the long run while it fostered AGDP by 0.64% in the short run. Thus, it is evident that genuine economic development cannot be achieved without a prominent improvement of productivity in the agricultural sector.

Key words: Agriculture growth, agriculture GDP, agriculture productivity, agricultural credit, total cropped area, availability of water, import of pesticide.

INTRODUCTION

Significance of agriculture

Agriculture can play imperative role in achieving the Millennium Development Goals that determine to half the share of people suffering from extreme poverty and hunger by 2015. Three out of every four poor people in developing countries live in rural areas, and most of them depend directly or indirectly on agriculture for their livelihoods. Agricultural productivity growth is vital for stimulating growth in other parts of the economy.

In Asia, overcoming widespread poverty requires confronting widening rural-urban income disparities. Asia's fast-growing economies remain home to over 600 million rural people living in extreme poverty, and despite massive rural-urban migration, rural poverty will remain dominant for several more decades. For this reason, the 'World Development Report' focuses on ways to generate rural jobs by diversifying into labor-intensive, high-value agriculture linked to a dynamic rural and nonfarm sector (World Bank, 2008).

Agriculture is the prime sector of Pakistan's economy with respect to employment generation; Pakistan's two-third population depends directly or indirectly on this sector. Thus, for the overall economic development and poverty reduction in Pakistan, sustained and higher growth in agricultural production is necessary (Iqbal et al., 2003). A growth rate of more than five percent is necessary to attain a rapid growth of national income, provide employment to growing labor force, attaining macroeconomic stability, make available justice to the people and reducing poverty in Pakistan (Iqbal et al., 2003; Government of Pakistan, 2011a).

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Agriculture's role in socio economic development in many countries cannot be denied. Rural people's food security, livelihood and employment depend on the development of this sector. The direct impact of the agriculture sector on the national economy as well as the way in which it influence the other sectors of the economy positively contribute towards the improvement in the lives of masses in the country. It is proved by researchers that the agriculture sector provide basis for industry and other non agricultural sectors development. The agriculture sector provides raw material for industry and create efficient demand for industrial goods. These demand and supply incentives cause industrial expansion, which in turn contribute in economic growth in the country (Subramaniam and Reed, 2009).

The agriculture sector is a major source of foreign exchange earnings, as it produced raw and processed agricultural products for exports. It has great importance due to its inter-linkages with the rest of the economy. In order to maintain high growth rate in national income, employment creation for rapidly growing population, attaining food security, ensuring macroeconomic stability, removing income inequalities and reduction in rural poverty in the country, the rapid growth in the agriculture sector is essential.

Emerging opportunities

A rapid increase in the food prices in 2007 and 2008 caught the attention of the world. The agriculture sector now has importance not only for providing enough food for the people but also to provide basis for the development in a globalized economy. There is a critical need to ensure food security for the poor people of the countries like Pakistan, who spend almost 80% of their income on food. There are a number of reasons which create imbalance between supply and demand of food, which results in shooting up the prices of these necessities. These reasons are: increased cost of production of food, poor yield of food crops in major agricultural regions, increased oil prices results in higher costs of processing and marketing, higher demand for food due to growing population especially in China and India, food crops consumption for humans have diverted towards the manufacturing of animal food and production of bio fuel. These fluctuations in prices of food put the poor people at risk and it will increase poverty in many developing countries. Persistent food insecurity in developing countries is due to negligible investment in agriculture research as a percentage of the agriculture's Gross Domestic Product (GDP). Pakistan did not pay attention on maintaining their irrigation infrastructure. Poverty reduction and food security is also possible by investing in development of improved technology and making it available to poor farmers (Iqbal and Amjad, 2009).

If increase in food prices persist in the future and demand for food has an upward shift then it may signal that international terms of trade has become in favor of agriculture. Then development of the agriculture sector is not only necessary for food security but it can also become an engine for economic development and growth for the developing countries like Pakistan. Technical and scientific advancement, new methods of cultivation and introduction of hybrid seeds results to a large and sustained increase in agriculture production (Amjad, 2009).

Planning Commission of Pakistan developed a framework for economic growth where long-term structural issues could be solved by recommending policies and reforms that will encourage productivity and innovation, etc (Government of Pakistan, 2011b). Although, in the growth framework, agriculture is not directly addressed but its productivity is imperative for stimulating growth in other parts of the economy because it is the mainstay of the economy in most developing countries where substantial poor farmers are engaged in agriculture. But accelerated growth requires a sharp productivity increase in small holder farming combined with more effective support to the millions coping as subsistence farmers, many of which are in remote areas.

REVIEW OF LITERATURE

Zuberi (1989) stated that the strategy for agricultural development in the country had been based on greater utilization of 'high pay-off' low cost technology. Loans were advanced by the government through financial institutions to make it possible for the farmers to acquire this technology. 70% of the institutional credit was used for the purchase of seeds and fertilizer. The study showed that meaningless results were produced with specifications in which credit is taken as an independent variable. But using spending as a proxy for credit and capital, also using labor gave significant estimates. It is judged that the changes in the amount of expenditure on fertilizers and seeds and the number of labor could explain 97.5% output changes, while all other factors assumed as constant.

Malik et al. (1989) highlighted the growing and serious problem faced by the small and tenant farmers regarding the access to institutional credit. Parikh and Shah (1994) in their study dealt with the estimation of technical efficiency in agricultural production in the North West Frontier Province of Pakistan. This study measured technical efficiency using a translog frontier production function on cross sectional data from 397 farms in the area, for the year 1988-1989. The results showed that family size (due to shortage of labor in the area), education and credit per acre increase farm efficiency, while fragmented land decreases it significantly.

Faruqee (1995) stated that agriculture was a key factor in impressive GDP growth of Pakistan from mid seventies to mid nineties. He inferred that during different time

periods, sources of growth had been different. In the 1960s, it was seeds, fertilizers and irrigation package; in the 1970s, it was fertilizers and intensifying water; and in the 1980s, it was betterment in crop management and incentives.

Hussain and Ishfaq (1997) observed the relationship between poverty and aggregate agricultural productivity as well as estimated the determinants of agricultural production or the central inputs; through the course of time, the study showed that in Pakistan poverty has lessened due to the expansion in agricultural productivity but the negative effects of high population growth and food prices are overwhelming. The results showed that through time in Pakistan, size of the cropped area as well as fertilizer off-take played very important role in increasing agricultural production historically, especially on the verge of Green Revolution, in the late sixties.

Nagy and Quddus (1998) reviewed the status and problems of the Pakistan agriculture research system, they discussed why improvements in Pakistan agriculture research system are needed and on the basis of the plan developed for the National Master Agricultural Research Plan (NMARP), an agenda for Pakistan agriculture research system was given. The authors revealed that the factors that affect the agriculture production and productivity growth in Pakistan are land and water resources in combination with new interventions from research.

Coleman (1999), based on double difference comparison between program and control villages and between eligible and ineligible households, estimated that there was no evidence of any impact of micro finance. Khandker and Faruqee (1999) estimated the productiveness of the Agricultural Development Bank of Pakistan (ADBP) as a credit providing system. A two stage method is used to calculate the effect of credit which took into the endogenity of lending. It is shown by the results that contribution of ADBP to welfare of small holders was higher than for large holders, although large holders received more from ADBP finance. In providing rural finance, ADBP was not a cost-effective scheme. The cost-effectiveness of ADBP can be enhanced by targeting small holders in agriculture where credit provides better results and also by lowering its loan default.

Mosley (2001) used Latin American countries data and estimated growth of income and assets of the borrowers which was more than those of the control groups. But he did not find any evidence that microfinance had any impact on extreme poverty. Saboor (2004) assessed the influence of various factors on poverty level and forecasted the co-integrated trends of agricultural growth, rural poverty and income inequality of a household in Pakistan by calculating trend analysis of rural poverty and income inequality by applying axiomatic approach. The study revealed that agriculture growth remained anti-poor from 1990-1991 to 1992-1993 and was pro-poor from 1992-1993 to 1998-1999 in rural Pakistan. If the growth would remain pro-poor in the future then it will trickle down to the poor in more than the non-poor. Rural poverty can be reduced with the increase in land use intensity, cropping intensity, agricultural growth, education and number of wage earners in a family.

Abbas et al. (2005) studied the role of micro credit in income generation and poverty reduction. The study used regression and correlation methods for empirical analysis. The empirical evidence showed a positive impact of micro credit on income and consumption, if it would be provided smoothly and utilized in a rational way.

Iqbal and Ahmed (2005) reviewed the current status of Pakistan's agriculture and discussed the capability of various factors to contribute towards a higher and sustained growth of the sector in future. The study focused on the role of science and technology to achieve sustainable agriculture growth and on precedence of the future research and development efforts. R&D is enormously important, but it would be supported by human resources development, favorable policy instruments, necessary physical and institutional infrastructure, etc. The most limiting factor in the coming years was identified as shortage of irrigation water.

Anriquez and Valdes (2006) analyzed determinants of rural household and farm related income, by using the data of Pakistan Institute of Development Economics (PIDE) and Pakistan Rural Household Survey (PRHS) in 2001. A Statistical approach was taken, which accounts for different sources of farm income: off farm employment, farm production, remittances and transfers and returns to assets. The study found that formal as well as informal credit was positively correlated with land. Poorer and small farmers mostly rely on informal credit markets. For the small farmers, elasticity of informal credit is statistically significant and negative; as such, it might exhibit over borrowing, which has negative impact on production value. Water as input showed increasing revenue elasticity with farm size. But only the estimates of small and medium sized farms are significant.

Hamid and Ahmed (2009) used data from 1972-1973 to 2006-2007 and applied Cobb-Douglas production function to explain the variations in agriculture value added. According to the production function used in the study, value added in agriculture depends on labor employed in agriculture, capital stock, intermediate inputs in the agriculture, level of technology, human resources developed in the agriculture and trade. Intermediate inputs include fertilizers, high yielding variety of seeds, pesticides, etc. Modern machinery is vastly used coupled with pesticides, fertilizers and high yielding varieties of seed contributed to the value-added growth in agriculture and Gross Domestic Product (GDP) growth on the one hand and decline labor absorptive capacity on the other hand, especially for those who got general education or are illiterate.

Shirazi and Khan (2009) estimated the impact of micro

credit on poverty alleviation of the borrowers by using the data collected in Gallup (2005). The impact of Pakistan Poverty Alleviation Fund (PPAF) on poverty status of the households was examined by employing counter-factual combined approach. The study estimated that micro credit has no impact on poverty status of extremely poor borrowers as their poverty status showed marginal increment of 0.63% point.

Objectives of the study

The overall objective of the study is to examine the factors contributing to agricultural growth in Pakistan during the period of 1970 to 2009. Specifically, the study intends to achieve the following objectives:

- Analyze the impact of total cropped area, agriculture credit disbursed, availability of water, improved seeds distribution and import of pesticides on agriculture during the period of 1970 to 2009.
- Suggesting some agricultural policy measures for enhancing growth in the country, particularly with reference to the above mentioned factors and agricultural development.

METHODOLOGY

Data collection

This study was based on secondary data. The annual time Series data pertaining to agriculture gross domestic product (AGDP), total cropped area, water availability, agricultural credit, improved seeds distribution and import of pesticide relating to the period of 1970 to 2009 was collected from Economic Survey of Pakistan, Federal Bureau of Statistics (various issues).

Johansen methodology

The time series data included in this study were non stationary. In order to eradicate the problem of non stationary, the latest techniques of Co-integration were adopted. A process to assess a co-integrated system is developed by Johansen and Juselius (1992), which involves two or more variables. This method is independent of the choices of the endogenous variables and the existence of more than one co-integrating vectors for estimation and testing in the multivariate system is also possible. The same model was used by Subramaniam and Reed (2009) in their study. However, the general model can be described as follows in Equation 1:

$$X_t = Ð X_{t-p} + \sum_{i=1}^{p-i} \psi i \; X_{t-i} + \gamma Ð_i + e_t \qquad (1)$$

Where: *Xt* = the column vector of the current values of all the variables in the system (integrated of order one); $Ð_i$ = a matrix of deterministic variables such as an intercept and time trend; e_t = the vector of errors are assumed as $E(e_t é_t) = Ω$ for all t; ψ,Ð, γ = the parameters' matrices; *p* = the number of lag periods included in this model, which is determined by using the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (BIC); Ð X_{t-p} = captures the long-run effects on the regressors; and $\sum_{i=1}^{p-i}$ ψi $ΔX_{t-i}$ = captures the short-run impact.

Response model for agricultural growth

In analyzing the impact of different factors on Agricultural GDP, the following model was constructed. The Agricultural GDP (AGDP) is assumed as a function of the total cropped area, water availability, agricultural credit, improved seeds distribution and import of pesticide. This model is estimated in Equation 2 as follows:

$$LAGDP = \alpha_o+\alpha_1 LLAND+\alpha_2 LCREDIT+\alpha_3 LSEED+ \alpha_4 LWATER + \alpha_5 LPESTICIDE \quad (2)$$

Where: LAGDP = log of real agricultural gross domestic product; LLAND = log of total cropped area; LCREDIT = log of agricultural credit; LSEED = log of improved seeds distribution; LWATER = log of irrigation water; and LPESTICIDE = log of import of pesticide.

Agricultural GDP comprises total agricultural product during the year. This study took the Gross National Product data from Pakistan Economic Survey (2008-2009). Land represents the total cropped area (in million hectares) used for cultivation during the year. Total cropped area is sum of net area sown and area sown more than once. This information is taken from Pakistan Economic Survey (2008-2009). Agricultural credit contains total credit (Millions Rs.) disbursed by different agencies during the year. These agencies are Zarai Taraqiati Bank Limited (ZTBL), Taccavi, Cooperatives, Commercial Banks and domestic private banks. Irrigation water, million acre feet (MAF) shows availability of water during the year for the farming. Seed (000 tonnes) includes improved seed distribution during the year. Pesticide consists of import of insecticides (tonnes) every year. However, the data were obtained from Pakistan Economic Survey (2008-2009).

RESULTS AND DISCUSSION

Empirical analysis

This study uses time series analysis to identify the linkages among agricultural GDP, total cropped area, water availability, agricultural credit, improved seeds distribution and import of pesticide. Mostly, the time series data were non stationary. In order to eradicate the problem of non stationary, the latest techniques of Co-integration were adopted.

Table 1. Evidence of stationary using Augmented Dickey Fuller Unit Root Test for all the data series.

Variable	Level	First difference
Agricultural GDP	-3.17	-6.69*
Land	-2.30	-10.92*
Agricultural credit	-2.63	-5.50*
Irrigation water	-2.60	-10.16*
Seed	-3.01	-6.20*
Pesticide	-2.14	-5.47*

Note: * shows that ADF test is significant at 5% level.

Table 2. Evidence of Co-integration using Maximal Eigen value and Trace Statistical Tests for Real Agricultural Gross Domestic Product, Pakistan.

Hypotheses			Maximum Eigen value test			Trace statistical test		
H_0	H_1[1]	H_2[2]	Eigen value	λ_{max} values	5% critical values	λ_{trace} values	Adjusted for d.f.	5% critical
r=0	r=1	r≤1	0.92	91.72*	44.50	196.06*	165.90*	117.71
r=1	r=2	r≤2	0.70	43.25*	38.33	104.34*	88.29	88.80
r=2	r=3	r≤3	0.44	20.75	32.12	61.09	51.69	63.88
r=3	r=4	r≤4	0.40	18.65	25.82	40.34	34.13	42.92
r=4	r=5	r≤5	0.35	15.31	19.39	21.69	18.35	25.87
r=5	r=6	r≤6	0.16	6.37	12.52	6.37	5.39	12.52

* denotes rejection of the null hypothesis. [1, 2] denote alternative hypothesis for maximum Eigen value and trace statistical tests, respectively.

Unit-root and order of integration analysis

In order to check the stationary of the data, all the variables were tested for unit root. For this purpose, the Augmented Dickey – Fuller (ADF) Test, prepared by Dickey and Fuller (1981), was used.

The null hypothesis of a unit root was not rejected (5% significance level), in any of the series, when tested at different levels. Therefore, all the series were non-stationary.

But unit root hypothesis was rejected while tested at first difference for all the series (Table 1).

The results show that the series are integrated at the first order, *I (1)*. Since all the series are at the same order, the data set is appropriate for further analysis.

Co-integrating relations

To obtain the number of distinct co-integrating vectors, the significance of the characteristic roots was checked. The procedure indicates two co-integrating relationship among explanatory variables and the real agricultural GDP (Table 2). But when λ_{trace} statistic values adjusted for degree of freedom was calculated, it showed one co-integrating equation. There exists unique relationship among the variables.

Impact of different factors on real GDP

Using the Akaike Information Criterion (AIC) for optimal lag, two lags were included. The model included a co-integration space, and a constant and a time trend in the short run (Figures 1 and 2).

In the case of AGDP, the adjustment coefficients of land, pesticide and water were significant. Any deviation from the equilibrium resulted to an adjustment of 0.11% in case of land and water, while pesticides would adjust to 1.4% in the same year.

The Johansen normalized estimates for real agricultural GDP are presented in Equation 3. The study showed estimates of 'long-run' elasticity of agricultural GDP with respect to land (total cropped area), water availability, agricultural credit, improved seeds distribution and import of pesticide. However, their t-values are shown in parenthesis.

$$LAGDP = -5.676 + 2.13LLAND - 0.198LCREDIT + 0.509LSEED + 0.28LPESTICIDE + 0.933LWATER \quad (3)$$

$$(3.66) \quad (8.05) \quad (9.93) \quad (9.50) \quad (1.95) \quad (3)$$

The results showed that all the estimates are statistically significant at 5% level. Short run elasticities of agricultural gross domestic product, land (total cropped area), water availability, agricultural credit, improved seeds distribution

β matrix:

LAGDP	1.000
LLAND	−2.130
LCREDIT	0.198
LSEED	−0.509
LPESTICIDE	−0.280
LWATER	−0.933

Figure 1. The estimated long-run estimates 'β' for Real Agricultural Gross Domestic Product, Pakistan.

α matrix:

LAGDP	−0.173
LLAND	0.112
LCREDIT	0.071
LSEED	−0.021
LPESTICIDE	1.403
LWATER	0.109

Figure 2. The estimated speed of adjustment coefficients 'α' for Real Agricultural Gross Domestic Product, Pakistan.

and import of pesticide are exposed in Equation 4. However, their t-values are shown in parenthesis:

D(LAGDP(-1))	D(LLAND(-1))	D(LCREDIT(-1))	D(LSEED(-1))	D(LPESTICIDE(-1))	D(LWATER(-1))	**(4)**
-0.258301	-0.465888	0.052580	0.054619	-0.045160	0.643001	
(-0.95777)	(-1.18014)	(0.95700)	(1.01384)	(-1.62049)	(1.76364)	(4)

The results in Equation 3 showed that agricultural GDP was dependent on the land (total cropped area), water availability, improved seeds distribution and import of pesticide. These were critical variables which contributed to agricultural product which in turn affects the GDP.

These results are also supported by other studies. Faruqee (1995) revealed that sources of growth have been different during different time periods. In the 1960s, it was seeds, fertilizers and irrigation package; in the 1970s, it was fertilizers and intensifying water; and in the 1980s, it was betterment in crop management and incentives.

Parikh and Shah (1994) discovered that the index of efficiency yielded high level of efficiency on average (mean level of 96.2%), suggesting the well developed infrastructure of the region and the usage of advanced inputs, for example, high yield variety crops (HYV), irrigation and chemical fertilizers for many years. Iqbal and Ahmed (2005) revealed that rapid growth in the sector could be affected by unjust use of pesticides, limited certified seed production capacity, degradation of land, and inefficient use of water resources.

Dorosh and Salam (2007) stated that Green Revolution package of inputs (improved seed, fertilizer, and irrigation) caused an increase in agricultural output and productivity, despite the price disincentives. Major investments in land and, especially in water supply through tube wells increased the net sown area. Hamid and Ahmed (2009) highlighted that modern machinery coupled with pesticides, fertilizers and high yielding varieties of seed contributed to the value-added growth in agriculture and Gross Domestic Product growth.

The long-run relationship between the Agricultural GDP and Land (that is, the total cropped area (million hectares)) was positive for the Pakistani economy (Equation 3). The short run elasticity of land with respect to AGDP was 0.47 and long elasticity was 2.13. Thus, 1% increase in total cropped area on average could enhance AGDP by 0.47% in the short run and 2.13% in the long run.

Hussain and Ishfaq (1997) revealed that size of the cropped area as well as fertilizer off-take played a very important role in increasing agricultural production historically, especially on the verge of Green Revolution, in the late sixties. Saboor (2004) assessed that rural poverty can be reduced with the increase in land use intensity, cropping intensity, agricultural growth, education and number of wage earners in a family.

The long-run relationship between the agricultural GDP and agricultural credit was negative for the Pakistani economy (Equation 3). This means that as the agricultural credit grows, the growth of agricultural sector

will diminish, holding all other variables that affect the agricultural sector constant. This contradiction might be explained by a number of factors. The agricultural credit long run elasticity was significant, which revealed that agricultural credit provided to the farmers was not used to enhance capabilities in farm productivity. Small and tenant farmers usually could not be able to get agriculture credit. There will be a positive impact of credit on income and consumption only if it would be provided smoothly and utilized in a rational way.

Malik et al. (1989) highlighted the growing and serious problem faced by the small and tenant farmers regarding the access to institutional credit. Khandker and Faruqee (1999) explained that the cost-effectiveness of ADBP can be enhanced by targeting small holders in agriculture, where credit provides better results and, also by lowering its loan default. Coleman (1999) estimated that there was no evidence of any impact of micro finance.

Mosley (2001) did not find any evidence that microfinance had any impact on extreme poverty. Abbas et al. (2005) revealed a positive impact of micro credit on income and consumption only if it would be provided smoothly and utilized in a rational way. Anriquez and Valdes (2006) found that the small farmers' elasticity of informal credit is statistically significant and negative; as such it might exhibit over borrowing, which has negative impact on production value. Shirazi and Khan (2009) estimated that micro credit has no impact on poverty status of extremely poor borrowers as their poverty status showed marginal increment of 0.63% point.

Availability of quality seed and at affordable price to all the farmers is important for higher crop production. The long run elasticity of seed was greatly significant for AGDP but short run elasticity was not significant (Equations 3 and 4), viewing that improved seed quality resulted in expansion of agricultural product in the long run. One percent increase in use of improved seed, on average caused 0.51% increase in AGDP in the long run.

Zuberi (1989) highlighted that the changes in the amount of expenditure on fertilizers and seeds and the number of labor could explain 97.5% output changes, while all other factors are assumed as constant. Amjad (2009) found that technical and scientific advancement, new methods of cultivation and introduction of hybrid seeds results to a large and sustained increase in agriculture production.

A likely rise in import of pesticides helped the farmers to protect their crops from insecticides which in turn amplified farm production and hence enlarged AGDP. The long run elasticity of pesticides for AGDP was highly significant but short run elasticity was not significant which revealed that import of pesticides affected the growth in the long run. A 1% increase in pesticides, on average, increased AGDP by 0.28% in the long run.

The irrigation water long run elasticity was significant, thus having demonstrated an effect on the AGDP. It provided the fact that water has very critical position in farm production; 1% increase in availability of water, on average boosted the AGDP by 0.93% in the long run while it fostered AGDP by 0.64% in the short run.

Nagy and Quddus (1998) stated that factors which affect the agriculture production and productivity growth in Pakistan are land and water resources in combination with new interventions from research. Anriquez and Valdes (2006) found that water as input showed increasing revenue elasticity with farm size, but only the estimates of small and medium sized farms are significant.

This study revealed that agricultural GDP was dependent on the total cropped area, water availability, agricultural credit, improved seeds distribution and import of pesticide. Total cropped area has maximum impact on AGDP as the short run elasticity of total cropped area with respect to AGDP was 0.47 and long elasticity was 2.13. Thus, 1% increase in the total cropped area could enhance AGDP by 0.47% in the short run and 2.13% in the long run. Hussain and Ishfaq (1997) also stated that the size of the cropped area as well as fertilizer off-take played very important role in increasing agricultural production historically.

The second important variable which affects AGDP more is irrigation water; its long run elasticity was significant. It provided the fact that water has very critical position in farm production; 1% increase in availability of water, on average, boosted the AGDP by 0.93% in the long run while it fostered AGDP by 0.64% in the short run. Faruqee (1995), Nagy and Quddus (1998), and Anriquez and Valdes (2006) also revealed the importance of water in AGDP growth.

Conclusion

It is evident from the study that total cropped area, water availability, improved seeds distribution and import of pesticide positively affected AGDP, while agriculture credit has negative effect on AGDP. Total cropped area and irrigation water are the most significant among these sources.

In order to enhance the impact of these variables on AGDP, the following steps can be taken. Uncultivated lands can bring in use and a piece of land can be used for more than one purpose for cultivating the crops. Priority should be given to development and enhancement of the water sector. Pakistan is facing serious irrigation water shortages; therefore, there is a need for judicious use of this scarce resource. In this connection, both water management as well as developing new water storage sites/dam is the need of the day.

It is recommended that supervised easy and cheap credit should be encouraged with strong monitoring and agricultural extension services. This will of course help in boosting agricultural production. However, appropriate and supervised credit scheme for credit disbursement

must be demand driven too. The private sector credit institutions should be encouraged to provide farm inputs to farmers. Capital investment should be provided to the agriculture sector for the farm infrastructures and value added ventures. Micro credit facilities should be enhanced, especially to rural poor and non-farm households.

There is a need to check pesticides use. In this connection, integrated pest management should be encouraged through farmer school participatory approaches. The key factor which was behind the Green Revolution was introduction of the new varieties through the production of seed. It is imperative for the government to give maximum attention to their sustainable supply for the overall as well as agricultural growth. To overcome the crisis in the agriculture sector, the institutional framework for irrigation, seed development, and extension services would have to be rationalized. Allocating more finances is not enough but improving the management capability of the institutions is important too, as it can enable a high and stable agricultural growth in future.

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