



Background Paper

Promotion of Agriculture in Pakistan



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Printed in Pakistan

Published: October 2015

ISBN: 978-969-558-546-7

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PREFACE

Promotion of Agriculture in Pakistan is a background paper authored by Mr. Muhammad Asif Khan, an Agriculture Economist/ M&E Specialist who has previously worked with the World Bank and other foreign Donors, for the benefit of participants of the Pakistan-India Legislators and Public Officials Dialogue on Sharing of Experiences on Governance and Democracy scheduled to be held in Lahore and Karachi on October 06-09, 2015.

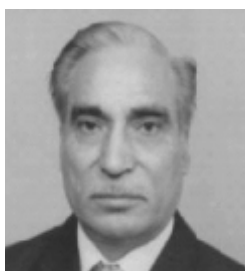
The paper outlines various developments that have taken place in the Agriculture Sector in Pakistan over the years. Mr. Khan outlines the strengths and weaknesses in the key policies adopted by the Country and suggests areas and possibilities of improvement in the sphere of Agriculture in Pakistan by comparing it with India.

Disclaimer

The views expressed in this paper belong to the author and do not necessarily represent the views of PILDAT.

Islamabad
October 2015

ABOUT THE AUTHOR



Mr. Muhammad Asif Khan is an Agricultural Economist/ Monitoring and Evaluation Specialist. He was born on April 03, 1945. He completed his BSc in Agriculture from the University of Agriculture in Faisalabad in 1964 followed by MSc in the same field from the same university, specializing in Agriculture Marketing in 1967. He is a leading pollster, Financial/ Economic Analyst and CosTab Specialist with expertise and a strong passion for survey research and qualitative/ quantitative research including impact evaluation research and Project Completion Reports. He has more than 35 years of experience in the areas of impact assessment, monitoring and evaluation, need assessment, studying social attitudes and behavior, flood damage assessment etc. He has used applied statistics for various projects funded by IFAD, DFID, World Bank, JBIC, USAID, KFW, UNDP, ADB, FAO, HTSPE, EUROCONSUT, local consultants (NESPAK, ACE, NDC, DMC, CAMEOS), and Provincial Governments and has worked on various assignments in Afghanistan, Sudan, YAR, Vietnam, and Nigeria. Mr. Khan's hold a membership of many Agriculture Institutions including the Pakistan Institute of Development Economists (PIDE), Pakistan Association of Agricultural Social Sciences and Pakistan Society of Agricultural Economics (PSAE). His strength and interest have been Financial/ Economic analysis of developmental projects, entry of project cost using CosTab under various categories/ sub categories, formulation of Questionnaires and the collection of primary data and impact assessment studies etc.

Agricultural Sector in the Economy

Pakistan has a rich and vast natural resource base, covering various ecological and climatic zones. With 17.58 mha (82%) of irrigated area and 8.9 million hectares of cultivable wasteland, its cropped/cultivated area has increased from 11.6 million hectares in 1947 to 22.6 million hectares in 1997. Agriculture continues to be the largest sector, a dominant driving force for growth and the main source of livelihood for 66% of the Country's population. It accounts for 21% of the total GDP and employs 43.6% of the total work force. The contribution of the sector to the GDP has declined gradually since its existence, from over 50% in 1949-1950¹ to about 21% in 2013-2014.² The average annual growth rates in the Agricultural Sector during the 1960s, 1970s and 1980s were 5.07%, 2.37% and 5.4%, respectively. With a new agriculture package announced in April 1997, the annual growth rate of the Agriculture sector during 1997-1998 improved to 5.9%. However the rate of growth stayed as low as 0.2% in 2009-2010, improving to 2.9% for the year 2014-2015.

Over the past 20 years some important structural changes have taken place in the sector. In particular, livestock has emerged as an important subsector, presently contributing 56% of the agricultural GDP,⁴ compared to about 28%, 20 years ago. Milk, the single most important component of livestock, values more than the combined value of agricultural crops⁵ Similarly, fisheries and forestry, while still minor contributors to agricultural GDP, have grown rapidly.

Land Use

With a total geographical area of 79.6 million hectares, Pakistan has currently 27% of it under cultivation, of which, 80% is irrigated.⁶ The country has one of the highest proportions of irrigated cropped/cultivated area in the world.⁷ The cultivable wastelands offering good possibilities of crop production, amount to 8.9 million hectares and the growth in cropped/cultivated area is

very impressive: from 11.6 million hectares in 1947 it has increased to 22.6 million hectares in 1997.⁸

Saline and Waterlogged Soils

Soil salinity and sodicity problems are common in arid and semiarid regions, where rainfall is insufficient to leach salts and excess sodium ions out of the rhizosphere. Out of a total of 6.30 mha of salt-affected land in the country, 1.89 hectare is saline, 1.85 million hectare is permeable saline-sodic, 1.02 million hectare is impermeable saline-sodic and 0.028 million hectare is sodic in nature. The salt affected soils are mainly situated in the plains. It is estimated that out of 1.89 million hectares of saline patches, 0.45 million hectares is in Punjab, 0.94 million hectares in Sindh and 0.5 million hectares in KPK.

Water Availability

Most of Pakistan is classified as arid to semi-arid because rainfall is not sufficient to grow agricultural crops, forest, fruit plants and pastures. About 68% of the geographical area has annual rainfall of 250 mm, whereas about 24 percent has annual rainfall of 251 to 500 mm^{9,10}. Monsoon in Pakistan contributes almost 65 – 75% of the total annual rainfall in Pakistan.¹¹ Only 8% of the geographical area has annual rainfall exceeding 500 mm.¹² Natural disasters like droughts and floods are a permanent feature of the area. Thus supplemental water is required for profitable agricultural production, either from irrigation or through water harvesting (flood water use, efficient irrigation etc.).

Water availability is the major driving force of the rural economy. Dry areas of Pakistan are characterized by rangelands and scattered patches of rain fed agriculture. These areas comprise 53% of the country and fall in southern parts of KPK, Punjab, Sind, Balochistan and parts of Northern Areas. Balochistan being the driest Province with water shortages that have limited the options for land based livelihoods to a bare

1. The Economist Pakistan Report 11/08/13
2. Pakistan Economic Survey 2014-15, Chap 2 – Agriculture, Ministry of Finance, GOP
3. Economic Survey of Pakistan 2014-15, Chapter 2, page 25
4. Punjab Livestock Policy 2015, not published yet
5. Punjab Livestock Policy, 2015, not published yet
6. The Economist Pakistan Report 11/08/13
7. The Economist Pakistan Report 11/08/13
8. The Economist Pakistan Report 11/08/13
9. The Economist Pakistan Report 11/08/13
10. Agriculture in Pakistan and its problems,
11. Monsoon Season in Pakistan Essay, ILM.com.pk dated July 20, 2013
12. The Economist Pakistan Report dated 11/08/13

minimum.

The Country has the largest contiguous, well-articulated and comprehensive irrigation system in the world with 3 storage reservoirs, 68 small dams, 19 diversion barrages and 45 canal commands with 12 Link Canals for inter-basin transfer of water. About 0.1 million outlets supply water to the farmers to irrigate land besides more than 600,000 tube wells. The whole irrigation network commands an area of 18 mha. Out of the total basin availability of 142 MAF, total quantum of water available to crops is only 42 MAF.^{13 14} Due to a shortage of canal water, farmers have to use tube well water however the quality of groundwater in places in Punjab and most of Sindh, is brackish.

Agriculture Policy Objectives

The Federal as well as Provincial Governments formulated piece-meal policies for the economic uplift of the farming community at different periods of time. The main objectives of the policies and the Acts/ Rules & Regulations framed have been:

1. Economic betterment in terms of steadily rising production, national income and standard of living of the people (area/ yield)
2. Lessening the disparities in income distribution;
3. Maximization of agricultural production in line with consumer demand and national objectives
4. The conservation of agricultural resources
5. Security of land tenure and justice in rent fixation etc.
6. National Food security

Policies Implemented

Pakistan does not have a formal operative "Agriculture Policy" at present. Various ad-hoc policy measures are framed from time to time (given in Section on Agriculture Inputs) related to:

1. Timely availability of fertilizer at Government fixed price, and certified seed
2. Better support prices
3. Reduction in interest rate of farm loans
4. Reduction in custom duties and taxes for farm machinery

5. Farmer's representation in Market Committees, etc.

As a result of various policy interventions, the production of wheat reached a level of 16.7 million tonnes in 1996-1997, while Basmati Rice increased by 13.7%.¹⁵ The overall production of rice registered an increase of 8.5% - the total production of rice during the year was 4.3 million tonnes, compared with 3.97 million tonnes in the previous year.¹⁶ A brief review of various policies as impacting the farmers presently, is as follows:

Agriculture Inputs

The supply, manufacture, import and distribution of various inputs are governed under various Acts/ Ordinances/ Rules promulgated from time to time. These include:

1. Seed Act, 1976: For seed procurement, seed breeding and distribution
2. Agricultural Pesticides Act 1992: To register importers, manufactures and distribution and to ensure its quality
3. Punjab Fertilizers (Control) Order, 1973: To check adulteration or spurious or fake fertilizers, under-weight bags, have control over the manufacturing of fertilizers
4. Agriculture Produce Market Act, 1939 (Amended in 1978)
5. Wheat Procurement Policy
6. Sugar Factories Control Act, 1950: To fix minimum price, ensure timely payments
7. On-Farm Water Management and Water Users' Associations Ordinance, 1981: for water course improvement to minimize water conveyance losses
8. The Canal and Drainage Act, 1873: To regulate and distribute water, and the reclamation of waterlogged & saline soils

Seeds & Pesticides

Policies relating to seed/ pesticide supply formulated by the Government are in the interest of the firms/ suppliers. Malpractices like the provision of mixed seed (maize & fodders), smuggling of sugarcane seed or the supply of adulterated pesticides are very common. Enforcement is lax and the suppliers are

13. Agriculture Policy in Pakistan – what it is and what it should be Sohail Jehangir Malik PhD Chairman Innovative Development Strategies (Pvt.) Ltd PIDE April 24, 2015
14. Agriculture Policy in Pakistan – what it is and what it should be Sohail Jehangir Malik PhD Chairman Innovative Development Strategies (Pvt.) Ltd PIDE April 24, 2015
15. Pakistan Review 11/08/13
16. Pakistan Review 11/08/13

rarely punished. This practice continues because of the ignorance on the part of the farmers in regards to the availability of relevant rules and their avoidance of lengthy court procedures.

Fertilizers

The Government is providing huge subsidies on imported fertilizers. However, the small farmers purchase these fertilizers that are necessary to replenish the reserves of nutrients removed or lost from the soil, at high prices during peak demand periods or because of their scarcity when they are required. The knowledge of the farmers about the right mix and quantities is extremely poor. Phosphatic fertilizer (DAP) among others is one of the fertilizers that is frequently adulterated. Many a times, the loss of soil texture and the reduction in yield is attributed to mismanagement of the use of the fertilizers. Farmers without considering the N:P:K balance for various type of soils, apply Nitrogenous fertilizer in larger quantities at the high end of the yield range, as compared to the low end.¹⁷ Lesser application of phosphorus and potash results in imbalance of soil fertility, thus leading to poor soil texture and lesser yield. In addition to this when farm yard manure (FYM) is heaped on the outskirts and it results in nutrient loss. The imported fertilizer is not released in time to create temporary shortages. The practice of provision of land 'Fard', restrictions on inter-provincial movement of fertilizers etc. as well as the cross-border smuggling (to Afghanistan) through KPK is a routine practice during peak demand period.

Electricity Tariff

The Electricity for the tubewells was previously subsidized.¹⁸ However, the Government in the last few years withdrew the subsidy and the farmers now have to pay the full cost of electricity – an even higher rate for the peak hour consumption (6:00 to 10:00 PM) as is the norm for the domestic consumers. In irrigated areas, the farmers operate tubewells in accordance with the 'warabandi' time for higher irrigation efficiency. Farmers are forced to pay high cost for pumping water if their 'warabandi' turn falls in the peak hours, as compared to others who are operating it in non-peak hours. In the Years 2015, the Prime Minister lowered the electricity tariff for peak hours but is still higher compared to non-peak hour for tube well users. It is learnt that electricity, for tube wells, is highly subsidized in India. though it has its own implications like excessive mining of aquifer.

Agriculture Credit

The Zarai Taraqati Bank, Cooperative Banks and commercial banks are involved in the disbursement of credit to the Agriculture Sector. However, despite the substantial growth of institutionalized credit in recent years, much of it is still beyond the reach of small farmers as they are unable to fulfill the requirements for the collateral required for the issuance of the loans. The credit limit per unit of land PIU (Produce Index Unit) has also been less. Although recently, the amount has been doubled by the Honourable Prime Minister, Mr. Muhammad Nawaz Sharif, MNA. For most small farmers and shared-croppers/cultivators the main source of credit is through moneylenders within the family and community. However these credit schemes have also created problems of false land registration, corruption by Patwaris and bank officers among others.

Price Support

The Government of Pakistan established an Agricultural Prices Commission in 1981 to recommend the extent and timing of appropriate adjustments in the pricing of agricultural inputs and outputs. One of their major policies to achieve the goal of sufficiency in production was to prevent the price of farm products from falling too low. The Government fixed a Minimum Support Price (MSP) on selected crops (wheat, rice, sugarcane) taking into account the production cost and inflation and international prices. Herewith making wheat the staple food, which was generally purchased by Food Department/PASSCO at the purchase centers, well spread in major growing areas. To benefit the small farmers, the supply of 'fard', issued by the concerned Patwari, was made obligatory. Smaller Farmers, to meet their daily needs chose to sell their wheat to market dealers/'beopary' at lower prices varying from Rs. 100 to Rs. 150 per maund (40 kg). Gunny bags are issued by the Food Inspector to the farmers at his discretion.

Though the Government of Pakistan had fixed the price of sugarcane at the Provincial level, however with the establishment of the sugar mills, farmers abandoned cane crushing at their farms and sold the sugar canes directly or through the 'thekedars' however one of the major problems associated with this practice was the late payment by the concerned sugar mills, Since the 'thekedars' get financial benefit by negotiating the price at 'Kanda' with the farmer against ready payment.

17. The optimum law of Liebscher, formulated at the end of the 19th century states that a production factor which is in minimum supply contributes more to production, the closer other production factors are to their optimum.

18. For further details please see the Agriculture Prices Policy in Pakistan, June 2012.

Amenities in the Markets

To manage the affairs of the markets and for establishing new markets, the Government of Pakistan in 1978 amended the old 1939 Agri. Produce Market Act. Under the amended Act, Market Committees (with representation of area farmers and dealers/ Commission agents & functionaries) were instructed to collect Market Fee from buyers and through the collected funds provide for amenities in the markets (shade/ shelter, rest houses, construction of roads etc.). However malpractices like the dealers and commission agents appointing their relatives as Chairpersons of the Market Committees instead of the farmers of the community led to the a larger control by the dealers/commission agents and relatives over the collected funds. Other malpractices like over weighment, kind deductions etc., were also common phenomenon.

Irrigation

Flood irrigation is the normal practice of applying water rather than furrow-bed irrigation especially suited for cotton-wheat area. Frequently there is over irrigation for hybrid maize, and rice primarily attributed to farmer's ignorance. Higher productivity and better quality of produce for vegetables (in Balochistan) irrigated by pressurized irrigation systems – drip, sprinklers and micro-sprayers,¹⁹ is a driving force to motivate farmers to adopt these efficient irrigation systems.

Groundwater Preservation

The Department of Agriculture has prepared a Groundwater Preservation Act for the management of Groundwater in Punjab. However, due to limited canal water availabilities, the installation of tubewells in 'marginally fit water' areas has resulted in salinity and water coning in other adjacent areas.

Drainage (Open Surface/ Tile)

The Government constructed drains in all the provinces of Pakistan starting from 1960s to overcome the menace of water logging and salinity under various SCARPs (Salinity Control & Reclamation Projects). In addition to this the respective Government/s also installed tubewells on the banks of canals, which were subsequently handed over to farmers at throwaway prices. One of the problems related to the drains included the lack of involvement of the beneficiary farmers during their designing/ planning and their implementation. Secondly, due to the non-cooperation

of some communities and the efforts to benefit some bureaucrats/ politicians, the alignments of these drains were changed resulting in water ponding in some places resulting in the infertility of the land.

Water Allocation

Irrigation water is allocated based on the area owned. There is different allowance in different areas ranging from 2 cusic/1000 acres to 13.5 cusic/1000 acres.²⁰ The system was designed for 60% cropping intensity whereas current intensities exceed 100 percent, even 175% in certain areas. Together with fluctuating and often short supplies, water availability has become unpredictable and subject to closures and rotations. Due to frequent closures, slow speed of water and poor maintenance the irrigation channels are clogged with silt. The two design assumptions for outlets being continuous full supply water level in the distributary and outlet modular flow conditions are no longer valid. The surface water distribution among the outlets is substantially inequitable. Some outlets, especially at the tail end or at top level of the minor/ distributary remain dry for up to 90% of the operational days in a year.²¹

Technical Advice/Awareness

Agriculture Department

Agriculture is now a Provincial subject after the 18th amendment. The Department is, headed by the Agriculture Secretary. Various wings of the department include: a) Agri. Extension, b) Agri. Research, c) On Farm Water Management, d) Agri. Engineering, each headed by the Director General. In addition there is the Directorate of Soil Fertility and Soil Conservation,

A number of developmental schemes are implemented from time to time. However, the efficacy of these schemes/projects remains to be seen. Some of the schemes implemented in various provinces include:

1. Provision of High Yielding and Rust Resistant wheat to farmers,
2. Promotion of Pulses cultivation, sometimes with subsidized seeds,
3. Kitchen Gardening in Urban Areas, by providing Seed kits,
4. Laying out of Demonstration Plots through Balanced use of fertilizer,
5. Food Security & Productivity Enhancement of Small Farmers under the Crop Maximization

19. Water for Balochistan –Policy Briefing, Volume (3), No. 3, 2007, by Dr. M. Shahid

20. Provincial Irrigation departments

21. Equity of water distribution along secondary canals in Punjab, Pakistan, by Muhammad N. Bhutta and Edward J. van der Velde

- Project,
6. Promotion of Tunnel Technology for Vegetable Production,
 7. Establishing a separate Adaptive Research discipline for latest crop production technology, according to the ecological conditions,

The Department monitors the availability of inputs in the field and also provide the following services to the farmers:

1. Preparation of crop sowing calendar, irrigation scheduling, post-harvest technology,
2. Pest Scouting/Pest Survey at different levels - Tehsil, Distt & Zonal
3. Provision of Soil and water conservation services in the barani and hill torrent areas
4. Develop culturable wasteland by subsidizing and Leveling cost, at varying rates,
5. Financial Assistance to the farmers/service providers for procurement of LASER land levelers.
6. Encourage HEIS (Drip, bubbler, conventional sprinklers) by subsidizing/cost sharing
7. Rehabilitation/development of irrigation schemes and tubewell watercourses by cost sharing,
8. Conveying messages to Agriculture Extension Agents,
9. Preparation of Training Manuals for various crops,
10. Collection and analysis of Fertilizer and Pesticide sample, to keep a check on its quality

Livestock & Dairy Development Department

This is an independent Provincial Government Department, headed by a Secretary. Livestock is an integral part of rural farming system, throughout the country. No formal Livestock Policy existed up until now, though there was collection of certain objectives at the Federal level. After the 18th Constitutional Amendment, Livestock is now a Provincial subject. The Punjab Livestock Policy has recently been formulated, aiming at “sustainable Livestock Sector development to ensure food security, enhanced competitiveness, quality life of stakeholders with exportable surpluses through vibrant and measurable Public Policy stimulation with targeted interventions. The thrust of the Government is to set the market led growth with the Government being a stabilizer of business environment and facilitator of business endeavours. Presently there is a vacuum in the area of disease control, preventive health standards, livestock vaccines, feed ingredients, and standard breeding

practices etc.

There is a dearth of fodder in the months of June to mid Sept. which affects health and productivity of animals. Making of silage (especially of maize) will result in a year round sustainable fodder availability, This is also liked by the animals as a palatable feed.

Crop Yields in India and Pakistan

A comparison of yields of major crops for Pakistan and Indian Punjab shows that the yields are significantly higher in Indian Punjab, due to:

1. Cheaper inputs especially fertilizers;
2. Less electricity tariff for water pumped
3. Timely fixation of support prices keeping in view the inflation and Government policy
4. Timely conveying well-articulated crop production messages
5. Involvement of beneficiary community in policy decisions.

Figure 1 shows that average yield based on the data for the period 2010-2011 to 2012-2013 is 58% and 31% for wheat and rice respectively in Pakistan compared to Indian Punjab. The yield of sugarcane is similarly less, at 79%.

Issues/ Challenges for Promotion of Agriculture

Most of the issues affecting agricultural production and productivity are water centric that demand construction of reservoirs, dams, barrages. Leaving aside these Mega-projects, various issues are categorized as: a) Water and b) Non-Water issues:

Water Related Issues

In order to meet fast growing needs of the growing population in terms of food & non-food items, the Agriculture Sector in Pakistan is required to have a sustained growth of more than 5% annually.²² The sector however faces various challenges:

Indus Basin Irrigated Areas

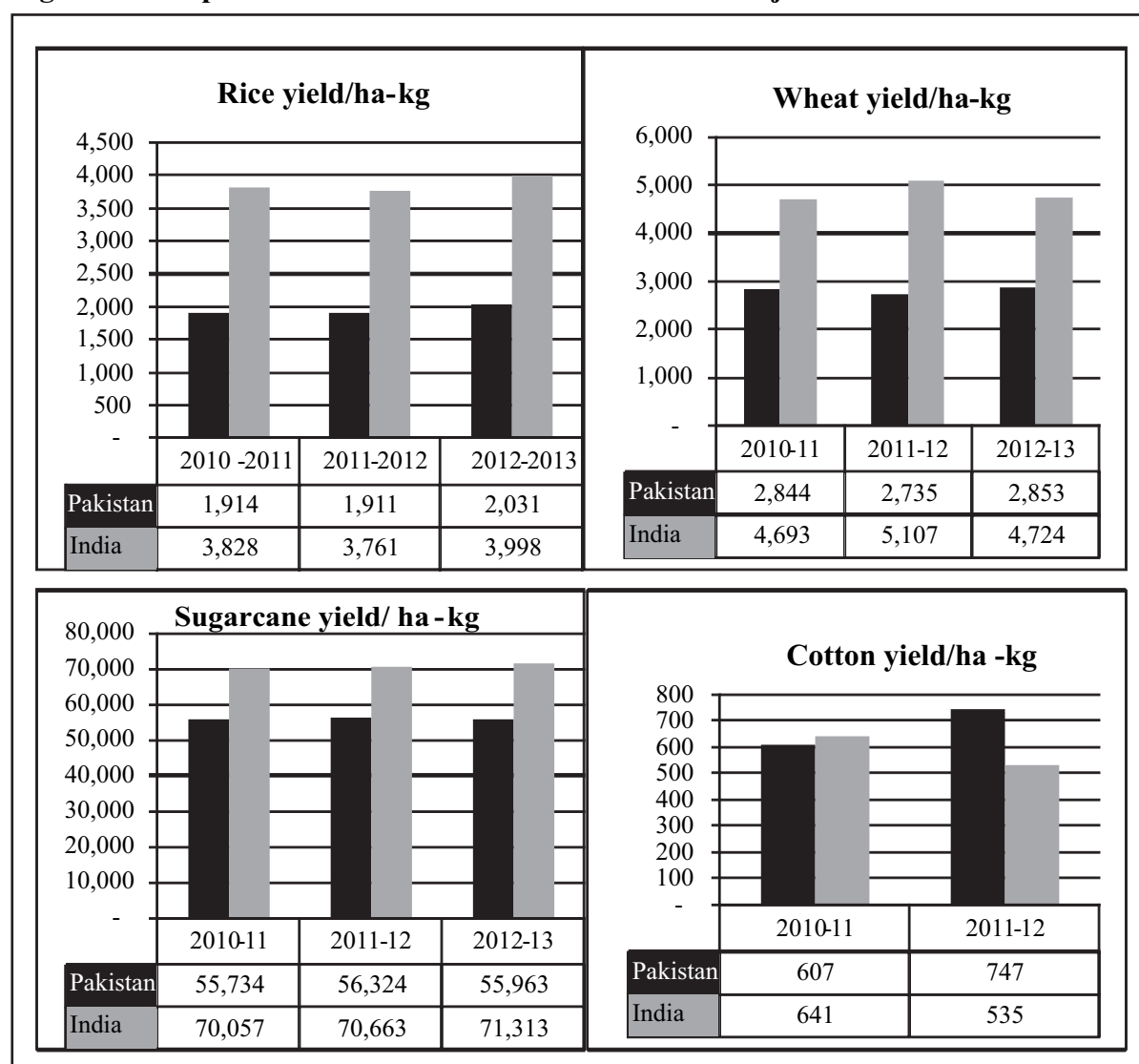
The Indus Basin Irrigation System today is the result of one century of supply-based policies. Surface water is supplied to more than 16.4 million hectares or 120,000 watercourses through an extensive network of main canals and secondary canals/distributaries. The

22. Pub No (WRR1(99):9, WATER MANAGEMENT IN ARID ZONES OF PAKISTAN: ISSUES AND OPTIONS, Munir Ahmad Dr. Shahid Ahmad

following issues are particularly important:

1. Water scarcity to meet the needs of increased area and cropping/ cultivable intensity
2. Irrigation water release pattern not commensurate with crop water requirements
3. Secondary salinization/sodification by pumping poor quality groundwater in certain areas
4. Prevalence of old system of Warabandi and crop-based water charges
5. Inefficient use of surface water resources in Sindh and Punjab (basin & 'puncho' system)
6. Rotational water release with political/feudal interference, at A, B & C levels, affecting equitable water distribution
7. Poor canal operational management - deferred maintenance, political/feudal interference
8. High seepage losses in the channels due to rotational irrigation water releases
9. Increased water availability at least by the same magnitude as the projected increase of farm production, by additional reservoirs, savings of

Figure 1: Comparative Yields of Indian and Pakistani Punjab



Source: Agri. Statistics, Punjab, India
Agri. Statistics, Punjab Pakistan

existing losses and introduction of the high efficiency irrigation systems with cropping patterns, which are water efficient.

10. Indiscriminate groundwater exploitation due to non-implementation of Groundwater Act

Mountainous Regions

The following water related issues persist for mountainous regions:

1. Degradation of rangelands and cutting of forest plants resulting in erosion of top fertile soil
2. Resource Depletion or 'water mining' (lowering by about 2 m per annum in the Northern Basin of the Quetta valley), affecting the Karez adversely, poses serious equity concerns
3. Deteriorating schemes due to non-involvement of beneficiary community in O&M
4. Institutional and Policy constraints restrict participation of farmers for effective water management.

Non-Water Issues

These include the following:

1. Development of a cohesive national agriculture, livestock and water policy following complete devolution to the provinces
2. Enhancing of production and productivity in less favored environments like Balochistan valley agriculture, Rod-Kohi, Barani lands, riverine areas, etc.
3. Ensuring year round fodder availability, possible by silage making
4. Ensure availability of quality seed of crops, vegetables and fodder, fertilizers & pesticides
5. Reduce/ minimize the chances of adulterated pesticides, livestock medicines
6. Ensure that small farmers are equally benefitted by MSP and credit facilities

Advancements in Technology

The Agriculture Department has taken a number of measures and developed prototype machines to save labour, carry out cultural practices and improve productivity. The improved technology is not yet widely disseminated but is adopted by some progressive farmers. It is difficult to estimate the contribution of improved technology. However, the interventions likely to be adopted at an enhanced scale in the near future are listed as follows:

1. Use of biogas to run diesel tubewells to mitigate

energy crisis

2. Designing of machines through prototype development to reduce labour cost, reduce losses, and increase yields (Mango Pruner, Corn Picker, Mechanical Vegetable Seeder, Vegetable Nursery Transplanter, Fodder Cutter cum Chopper, Silage Baler cum wrapper)
3. Construction of Mini Dams/ storage tanks for Water recharge, retaining walls, gully plugging, stream bank training and moisture conservation practices, to bring additional area under irrigated agriculture
4. Development of machines for management of wheat straw and management of cotton sticks
5. Introduction of silage, especially to meet periodic fodder deficiency (June to mid Sept)

Development Potential in Agriculture

There are a number of constraints affecting the planting of area and attaining potential yield. A cursory glance on yield variations with neighboring India and unexploited potential, there appears to be a huge potential to increase production and productivity based on existing levels of water availabilities. Digital innovations have provided an opportunity to create a transparent database of land ownership, type of tenancy, cropping pattern etc. enabling the planners to make policies in accordance with the farmers requirements for water, inputs, technical advice etc. In the light of the foregoing, the followings needs to be considered for future policy decisions:

Water Related Interventions

1. Preparation of cohesive National Water and Agriculture Policies
2. Management of floods in arid areas to mitigate the impact of droughts starting from watershed and/or storing excess floodwater in a cascade of storage dams to carry and transfer water of a wet year to a relatively dry year
3. Recharging groundwater and generation of new shallow aquifers
4. Diverting floodwater for spate irrigation and creating wetlands wherever possible to initiate new and additional concepts of livelihood like aquatic food resources and generating new shallow aquifers around the periphery of the wetlands
5. Water saving by efficient irrigation systems like sprinklers, bubblers, bed-irrigation
6. Construction of Mini Dams/ storage tanks for water recharge, retaining walls, gully plugging, stream bank training and moisture conservation

- practices, to bring additional area under irrigated agriculture
7. Better operational procedures at the distributary level to substantially improve water supply conditions in the tail reaches
 8. Designing water release pattern keeping in view the cropping pattern and crop water requirements in different canal commands
 9. Modifying the existing 'warabandi' system by 'warabandi' by equity²³ to achieve an approximately equal water supply per acre, to account for losses in the watercourse.
 10. Reduce electricity tariff for tubewells and introduce uniform rate for the whole day
 12. Arrange field trips to neighboring countries, e.g. western parts of Rajasthan in India, to see crop technologies, and exchange of ideas.
 13. Tapping the huge demand for agriculture products and by-products in neighbouring middle-east and near-east countries
 14. Value addition at farm level, also resulting in job creation
 15. Need for a system to cushion small farmers from market manipulations caused by the boom bust cycles of various crops due to market imperfections and uncertainties.

Non-Water Related Interventions

1. Designing cropping patterns considering the water availability, soil type, profitability of production system, farmers' preferences and market conditions²⁴
2. Introduce Biological Nitrogen Fixation for sustainable agricultural production
3. Create awareness for adoption of silage making to increase livestock productivity
4. Improve soil nutrient imbalance by reducing fertilizer prices that are not applied by the farmers (Phosphatic and muriate of potash)
5. Introduction of newly developed machines at subsidized rates to reduce production cost, and improve productivity
6. Take measures for provision of credit to small farmers in its true spirit
7. Introduction of 'joint farming' - assigning shares to each land owner to overcome the adverse effects of land inheritance and improve water conveyance efficiency
8. Determine MSP considering the production cost and inflation and its timely announcement
9. Regular broadcast of crop water and input requirements, and rainfall probability, on weekly basis to help farmers plan input/water application
10. Introduce the system of crop insurance
11. need for materializing a knowledge based sector turnaround in development management in the departments of Agriculture, Livestock and Irrigation for linear growth patterns of the Agriculture sector by creating farmer database using ordinary mobile phones at a nominal cost for dissemination of information, by messages;

23. Economic impacts of alternative irrigation water allocation institutions: Pakistan's warabandi system, by Chaudhry, M. A.; Young, R. A.; and Sampath, R. K

24. The crops like rice and sugarcane which require much more water compared to other crops must be evaluated considering the water use efficiency in terms of net return per unit of water.



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