

PROBLEMS OF AGRICULTURE IN PAKISTAN: AN INSIGHT INTO THEIR SOLUTION

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ABSTRACT

In a nation like Pakistan, where the security of one's food supply is critical for those living in poverty, it is imperative to take on the issue of increasing food production. According to estimates, food production must increase by at least 40% until 2025 to meet the long-term demands of the 33% predicted increase in population. Pakistan's agriculture faces significant difficulties in meeting the nation's food needs as a result of the population's growth, the irregular climate, and low crop production. The management of crop production presents many challenges for Pakistani farmers, including the absence of soil testing on farms, the unavailability and poor quality of fertilizers, loss during harvest, a lack of warehouses, machinery, and equipment, and, above all, a deterioration in soil fertility. In Pakistan, only tractors and cultivators are used for agricultural mechanization. The country is experiencing major issues with the production gap as a result of conventional farming methods and a lack of creative technology use. Production and average yield are vastly different. Furthermore, the country's food security policies are gravely in jeopardy due to the sharp rise in population. A significant increase in agricultural output is essentially needed to ensure the nation's agricultural future. To increase agricultural output and close yield gaps, the agricultural sector should utilize the most recent technological advancements. Land, design, farm equipment, seeds, fertilizer, irrigation, transport, and other resources are needed for agricultural operations. Farmers need to have simple access to finance to quickly and conveniently acquire these supplies. Because our farmers are so impoverished, the loans that banks offer to them are insufficient. The review article will briefly go over the mentioned problems, as well as some potential solutions that may be used in Pakistan's environment to increase agricultural output there.

Keywords: Agriculture; Modern technologies; Problems; Machinery; New technologies; Pakistan

1. INTRODUCTION

1.1. Significance of agriculture: Pakistan's economy is mainly reliant on agriculture. This industry is crucial for several reasons, including the fact that it supports our overseas trade and produces raw materials for industry. Exports of goods account for 45% of Pakistan's overall exports of foreign currency. It contributes 26% to the GDP and provides a living for 52% of the overall population. People who are directly involved in it make up 67.5% of Pakistan's population. A significant area where our ways of living and commercial innovation intersect is agriculture. It contributes to the industrial revolution, economic progress, food security, the reduction of poverty, and other aspects of any country's economy (Awan and Aslam, 2015). Agriculture is the industry where fundamental and commercial replicas collide. Agriculture's importance to the economy may be viewed from three angles: 1) as a

source of food for the country and raw materials for domestic industry; 2) as a source of goods and services for local industries and the global market and 3) as a way to generate foreign exchange. With a total area of 796,095 km², Pakistan has around 22 million km² of cultivated land and 8.3 million km² of uncultivated land. Pakistan is endowed with natural resources and spans a variety of climatic and ecological zones. Water and fertile land make up the majority of Pakistan's natural resources (Azam and Shafique, 2017).

1.2. Sectors of Agriculture: Crops, vegetables, fruits, livestock, and forestry make up the five sectors that makeup agriculture. 11.5% of the total is made up of animals, while only 8% is made up of crops, vegetables, and fruits. In Pakistan, crops provide people with staple foods, but vegetables give the country access to fresh vegetables. Simil-

arly to this, animals serve Pakistan's entire population with milk and meat (Khan *et al.*, 2018).

1.3. Major and minor crops of Pakistan: Pakistan's two primary harvest seasons are Rabi and Kharif. In Pakistan, wheat, maize, rice, cotton, sugarcane, and tobacco are well-known crops, while bitter melon, okra, pumpkin, spinach, sweet melon, and peppers are very well-known vegetables. Peach, apples, almonds, sweet oranges, pears, and watermelons are all popular fruits in Pakistan (Rehman *et al.*, 2015; Khan *et al.*, 2021b). Major and minor crops contribute 7.7 and 3.6%, respectively. Forestry and fishing each make contributions of 8.8% and 16.6%, respectively. In Pakistan, the human population is increasing day by day and requires roughly 27.3% fruits, 20% rice, 38% sugar, 62% wheat, 69% maize, 45% edible oil, and 15% cotton (Awan and Aslam, 2015).

1.4. Livestock, poultry, and forest: Small and large ruminants are the main livestock in Pakistan. The large ruminants are buffaloes, and cows, while the small ruminants are sheep and goats. The nation receives eggs and meat from poultry. Forestry contributes significantly to the country's ability to avoid sickness by giving it wood and medicinal plants. In the nation, the well-known trees are mulberry, Eucalyptus, Shesham, Milia, and many others. Plants are very important for cleansing the environment. A country must have 25% of its land covered in forests for development to occur (Spielman *et al.*, 2017).

2. Problems of Agriculture in Pakistan: Since Pakistan's independence, the agriculture sector has continuously participated in the country's economic contribution. It was once thought of as a dominant sector, but as a result of diminishing performance brought on by political, social, environmental, and climatic factors, it is now Pakistan's second-largest sector (Raza *et al.*, 2012). Even if Pakistan's agricultural industry is having issues, the majority of the country's income comes from it. Let's shed some light on the issues affecting Pakistan's agriculture sector and its potential for growth or development. Problems are divided into different groups such as techno-economic problems, natural problems, and socio-economic problems. All are discussed in this review.

2.1. Climate change: Achieving food security and reducing poverty in Pakistan is difficult due to the agriculture sector's climatic sensitivity and high vulnerability to growing weather variability and climate change. According to several studies, Pakistan's major crop output could be adversely impacted by reduced rainfall. A 0.5°C rise in national temperature during the previous three decades, and fluctuations in the frequency and severity of

droughts and floods between 1995 and 2022. In a similar vein, predictions show that Pakistan's average temperature increase (1.4°C–3.7°C) will be higher than the predicted global average (Bank, 2017; Abid *et al.*, 2017; Zulfiqar and Thapa, 2015, 2017; Mansoor *et al.*, 2021).

2.2. Reduction of soil fertility: The ability of soil to naturally provide nutrients to plants in sufficient quantities and the right proportions is referred to as soil fertility. The fundamental elements are known to be C, H, O, N, P, K, S, Ca, Mg, Na, Cl, Si, Mo, Zn, B, Fe, Mn, and Co. In extensive regions that have been used for agricultural production over the past 20 years, the loss of soil fertility is a significant issue. Increased specialization, concentration, and intensification of crop and livestock production without adequate consideration of the site-specific soil and climate conditions resulted in pronounced soil degradation and some irreversible soil damage, including processes i.e., soil compaction, water and wind erosion, water logging, chemical degradation, and humus loss (Hüttnl and Frielinghaus, 1994).

In Pakistan, there is a lack of machinery to stop soil erosion, and nothing is done to replenish the energy of the soil even after harvesting. As a result, soil fertility is deteriorating extensively. Pakistan's fertile layer is more than 6 inches deep, however, compared to other countries where it is only 4 inches thick, the average output is lower (Khan *et al.*, 2021a; Zia and Khan, 2012). Inadequate crop production, according to agricultural experts, is mostly caused by low soil fertility and a lack of effective and sustainable soil fertility management measures. According to soil specialists, "the majority of Pakistani soils are low in plant nutrients and incapable of supporting optimal levels of crop yield." The primary nutrients required for plant growth are phosphorus, potassium, and nitrogen and the nutrients required in minimal amounts are organic matter, copper, iron, zinc, and boron (Khan *et al.*, 2011).

2.3. Lack of water resources or reservoirs and dams: River levels in Pakistan have dropped to dangerously low levels. This is due to more than just a lack of rain. Rivers that flow into Pakistan from India, particularly the Indus, Chenab, and Jhelum rivers that pass through Indian-held Kashmir, are subject to flow restrictions. Pakistan has voiced opposition to Indian water projects, although a supposedly "independent" expert sent by the World Bank rejected the majority of Pakistan's complaints while also advising India to reduce the height of the dam. Pakistani journalists, pressure groups, and leaders are persuaded that India is attempting to choke off Pakistan's agriculture by

restricting river flows, which would undoubtedly have an impact on exports and increase Pakistan's reliance on food imports.

Pakistan is believed to be losing 13 million cusecs of water annually from its rivers into the sea despite being the fifth-richest country in terms of water resources due to a lack of reservoirs and dams (Table 1). The entire nation still uses antiquated flood irrigation technology, which wastes between 50 and 60 percent of the water. In many regions of the world, a brand-new high-efficiency irrigation technique called drip irrigation has been used. This not only conserves water but also provides the right amount of water for plants. To conserve and utilize most of our water resources, this method must be applied in our nation.

Table : List of major reservoirs of Pakistan.
Khoso et al. (2015) and Basharat (2019).

<u>Reservoirs</u>	<u>Location</u>	<u>Storage capacity(MAF)</u>
Rawal	Islamabad	0.0475
Warsak	Peshawar	0.0475
Mangla	Mirpur	5.6045
Tanda	Kohat	0.0788
Table	Abbottabad	10.2041
Khanpur	Khanpur	0.0593
Hub	Malir	0.0924

Pakistan's water demands are met by the Indus River system. Under extreme water stress, it would be fascinating to examine the water-sharing paradigm within the nation and beyond the border. Over the last decade, Pakistan has been prone to water scarcity. Pakistan has an estimated yearly water availability per person of 1090 m³, according to a UN study. The Food and Agriculture Organization of the UN (FAO) computes.

Total water withdrawal as a percentage of Total Renewable Water Resources (TRWR) to assess the impact on national water resources. If the TRWR number is greater than 25%, the stresses are deemed to be excessive. Pakistan's pressure is 74%, which is extraordinarily high compared to Afghanistan's pressure of 31% and India's pressure of 34%. The fact that Pakistan will become a water-scarce country by 2025, where water scarcity is a shortage in the availability of renewable freshwater compared to demand, indicates the severity of the water situation in Pakistan (Mustafa *et al.*, 2013; Samuel, 2019). Pakistani agriculture is also undergoing tremendous change at the same time. Increased contract farming, the emergence of more modern and commercial farmers, the displacement of food grains by high-value crops, and rising agricultural

commodity prices are all encouraging more people to enter the industry. These new agricultural opportunities necessitate new types of water conservation mechanisms. A paradigm shift in the development and management of water resources will be necessary for solutions. Water consumption in Pakistan is shown in figure 1 (Khoso *et al.*, 2015). Agricultural Water Demands by various crops are shown in figure 2 (Kahlowan and Majeed, 2003).

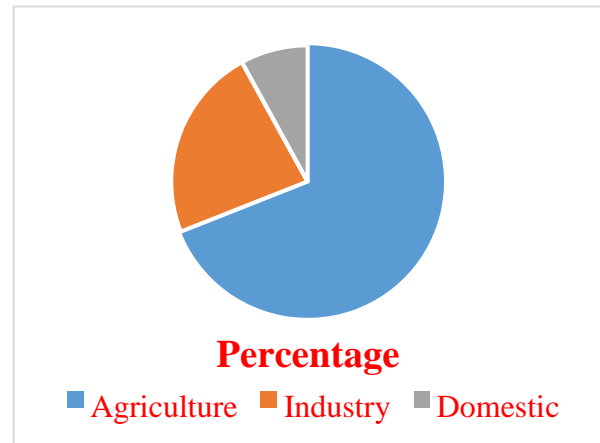


Figure-1: Total water consumption in Pakistan

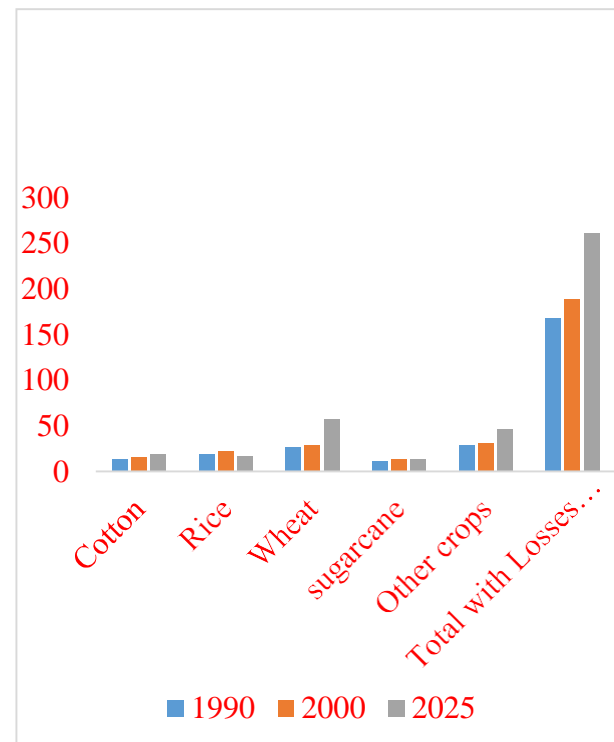


Fig-2: Agricultural water Demands

Due to a lack of water, only 17 Mha out of the 80 Mha of land that might be farmed is now cultivable, placing additional strain on the economy before meal grains can be imported. Basmati Rice, a fragrant long grain grown in the lowlands of north Punjab, is primarily grown in Pakistan. There are now some of Pakistan's top fruit kinds. In Pakistan, a huge variety of veggies are also produced. However, given the current circumstances, the lack of water causes a significant drop in the outputs and has a deteriorating impact on the development of the nation (Ali, 1993; Hussain *et al.*, 2020).

2.4. Flooding: Agricultural and horticultural crops can be badly affected by flooding in the last few years in Pakistan. The country is among the world's most climate-vulnerable countries, especially when it comes to flooding, and its farmers are particularly susceptible to agricultural devastation. The heavy flow of water coming from India into rivers can destroy the agricultural and which negatively affects the crops and livestock production in the whole country especially near by areas of rivers.

Massive natural disasters like floods, cyclones, droughts, earthquakes, and landslides have struck Pakistan. The worst floods in Pakistan were those that occurred in 1950, 1973, 1976, 1988, 1992, 1997, 2010, 2014, and 2022. These floods resulted in enormous financial and human losses. Large-scale floods in Azad Jammu & Kashmir (AJ&K), Punjab, and landslides in Gilgit-Baltistan (GB) occurred in September 2014 due to a severe and late monsoon spell that was accompanied by significant water discharges through the eastern rivers, particularly in the Chenab River. These events were unprecedented in terms of both volume and spatial coverage. 250,000 farmers and more than 1.0 million acres of agriculture were impacted, which in most cases led to the loss of cash crops, livestock, or stored food. The recovery effort was estimated to have cost US\$439.7 million (Rehman *et al.*, 2016).

Floods may occur due to severe hydrological and climatological processes, as well as an increase in the water level of a sea, river, or lake. It may occur at unpredictable rates and scales, which could ultimately result in human fatalities, destruction of crops and infrastructure, as well as loss of livelihood (Bukhari and Rizvi, 2017). According to Analytics' assessment from

2010, 1 million tons of food and seed supplies, as well as 1.2 million sugarcane, rice, and Kharif crop losses primarily cotton and vegetables were also reported. Additionally, it decimated the nation's textile industries (Arif-ullah, 2020; Ahmad and Afzal, 2022; Khayyam and Noureen, 2020).

2.5. Water logging and salinity: Two significant problems that endanger the viability of irrigated agriculture and have an impact on crop output in Pakistan are water logging and salt. Nearly 6.3 million hectares (M ha) have succumbed to the threat of salinity, with irrigated agriculture covering almost half of this area. The Indus Basin has undergone several attempts to manage waterlogging and salinity, including the use of tube wells, excessive irrigation-induced salt leaching, chemical application, and biological and physical approaches (Soharwardi *et al.*, 2021; Muniret *et al.*, 2021; Kirby *et al.*, 2017).

2.6. Lack of Irrigation Facilities: The extension of cropland in Pakistan is severely constrained by a lack of irrigation infrastructure. Lower water supply and water course losses in the fields are the major issues facing the agricultural sector. The actual amount of surface water is 91.8 million acrefeet (Khan, 2012; Syed *et al.*, 2022).

2.7. Lack of maintenance for water infrastructure and inequitable water distribution: In Pakistan, the funding for water services is appalling. The interest in the investment in water infrastructure is covered by general taxpayers; however, no one is responsible for replacing deteriorated infrastructure. Only a small portion of the operating and maintenance expenses are covered by the real users, the farmers. Additionally, Kamal (2009) reported that operation and maintenance are subpar since the government oversees irrigation services and many politicians give their supporters service employment. As a result, the infrastructure is in terrible shape. A century ago, when fresh irrigation canals were constructed, they were planned with parallel drainage canals to drain extra water from irrigated areas. Not everyone receives water, even in water-rich regions like Punjab, an upstream province with a sufficient water supply, and not everyone is water-deprived in Sindh, a province downstream where water supplies are scarce. The challenge of providing a fair allocation of water affects both provinces (Komal, 2009).

2.8. Lack of Proper Permanent Raised Bed Machinery: The lack of appropriate raised bed machinery in Pakistan is one of the key causes of less raised bed farming and low crop production. For some basic cash crops like tobacco, maize, cotton, etc., as well as some vegetables, farmers still employ traditional ways of building beds by hand and with animals. For the creation of narrow beds and ridges, some farmers have begun utilizing ridges with tractors. However, the farmers require the right equipment for constructing beds, seeding, fertilizing, spraying/ weeding, and harvesting (Awad, 2016; Sharif, 2011).

2.9. Lack of nutrients in the soil: Numerous nutrients regulate biochemical processes, offer resistance to illnesses, and ultimately degrade the quality of crops in the plant body. Food safety is a major concern due to the rapidly growing global population and the declining trend in crop yields. Therefore, it is crucial to apply nutrients in a balanced manner to maximize crop yield and produce enough food. Additionally, nutrients contribute significantly to the soil's fertility and increase its productivity for plant growth. Numerous elements i.e., soil light, temperature, nutrient availability, and water availability, affect plant growth. Nutrients are essential for crop growth and development and are given by the farmers to their crops at sowing time and during their growth.

There are two types of nutrients i.e. micronutrients (Fe, B, Mn, Cu, Zn, and Mo) and macronutrients (S, O, C, N, H, P, Mg, K, and Ca). Crop production is directly and indirectly associated with the applications of nutrients (micronutrients and macronutrients). Agriculture production can be reduced by the deficiency of these nutrients and soil fertility reduce due to the unavailability of nutrients (Tooret *et al.*, 2021; Adnan *et al.*, 2021).

2.10. Use of traditional methods of crop cultivation and harvesting: Additionally, Pakistan has a low yield per acre due to traditional farming and harvesting techniques, which implies that its average crop is only 1/4th as large as that of advanced nations. While other nations are increasing their output per acre by adopting cutting-edge scientific techniques. These states are doing this by enhancing their yield with new machinery. Poor harvesting and post-harvesting practices lead to both large income losses in terms of quantity lost and value reduction due to reduced prices as a result of quality fading in agricultural production. Post-harvest losses for various fruits range from 12 to 40% (Iqbal and Ahmad, 2005; Aujla *et al.*, 2011; Shahid *et al.*, 2010).

2.11. Inadequate Supply of Agricultural Input: High-yielding variety (HYV) seeds, chemical fertilizers, herbicides, mechanized machinery, etc. are examples of contemporary inputs that are not only expensive but also insufficient and inconsistently available in Pakistan. There are just 10 fertilizer production units in Pakistan.

2.12. Improper crop rotation and low cropping intensity: To restore the soil's fertility, crops must be properly rotated. The fertility of the soil is depleted by the continuous cultivation of one or two crops. Crop rotation should be done properly to restore fertility. The quantity of crops grown on a plot of land in a given year is referred to as cropping intensity. In comparison to developed nations, cropping intensity is low at the current stage of our growth. In Pakistan, the amount of arable land used for double or multiple crops is insufficient.

2.13. Plant diseases and natural calamities: Pests and insects frequently affect different crops like cotton, sugarcane, tobacco, wheat, and rice. Pests and plant disease lower agriculture's yearly productivity. Humanity does the labor, but Allah controls the outcome in the case of agriculture. Therefore, nature controls the development of agriculture. Pakistan's productivity has decreased by 20% as a result of unneeded rain and unfavorable weather conditions.

2.14. Underutilization of land and scarcity of high-yielding crop varieties: The majority of Pakistan's poor are employed in the agriculture industry. They cultivate utilizing conventional and orthodox methods. As a result of our farmer's lack of interest in using new and sophisticated agricultural techniques, the area under cultivation continues to be underutilized, unutilized, or misutilized. Due to the lack of High Yielding Variety (HYV) seeds, our underprivileged farmers are forced to use inferior seeds. However, if seed is offered, limited income prevents them from being purchased. Because of the poor quality of seeds, agricultural production is significantly hampered.

2.15. Farmer's litigation and political instability: Directly or indirectly, disputes between farmers are frequent and ongoing. They can frequently be found at government offices such as revenue boards, irrigation offices, and police stations. Due to the aforementioned issues, our farmer is unable to devote all of his time, effort, and labor to agricultural production. All areas of economic and social progress have been hampered by political instability. Unfortunately, Pakistan's political climate is unstable. Selling the products to different sectors as raw material upsets the farmers. On the other hand, political upheaval

makes people reluctant to invest in the agriculture industry.

2.16. Lack of credit and shortage of agricultural finance: In essence, our farmer is underprivileged and earns little money. There are hardly many agricultural credit facilities in Pakistan. Agriculture-friendly credit is not widely accessible. Additionally, there are non-institutional sources, however, due to their high rate of interest, they are not trustworthy. In Pakistan, 50.8% of the poor borrow money from landlords. Pakistan lacks adequate agricultural credit facilities. Credit for agriculture carries a high rate of interest and is rarely disbursed promptly. According to the "Pakistan Human Development Report 2003," 50.8% of Pakistan's impoverished borrow money from landlords at exorbitant interest rates.

2.17. Lack of marketing facilities: In Pakistan, the marketing infrastructure for agricultural products is still in need of much improvement. Due to a poor marketing strategy, our farmers are unable to receive fair pricing for their produce. Additionally, a significant portion of the produce is taken by the chain of middlemen between the farmers and the final consumers. As a result, the growers show little genuine enthusiasm for raising their output.

2.18. Lack of agricultural education and farmer training: Due to a lack of agricultural knowledge and current research methods, our farmers are unable to control the many crop diseases and pest and insect attacks. Low yields are the result. Our farmers are poorly educated and untrained, which results in low productivity. The government ought to launch a specific education program for farmers and provide them with training in agriculture.

2.19. Long duration load shedding: One of the most significant challenges to agriculture is load shedding. Over time, the loads are growing heavier. According to the Government of Pakistan (2011), more than 1,075,073 tube wells are used to irrigate the land, however, they are unable to perform at their best because of a severe electrical shortage. Diesel is an alternative that can be used to power these tube wells, but the increased cost of diesel has created another issue for the nation's farmers. Unannounced load shedding may interfere with the planting of various crops (Daily Nation, 2008).

2.20. The high price of fertilizers and the monopoly of companies: Natural gas price hikes and Pakistan's fertilizer industry's monopoly are the main causes of the country's high fertilizer prices. One of the factors contributing to this price

increase for natural gas is an increase in the general sales tax (Daily Nation, 2012). Every fertilizer, especially urea, which is employed on purpose in the agricultural sector, experiences a direct correlation between the rise in gas costs and the price per bag (Dawn, 2013). Due to the increase in the cost of these fertilizers, the average farmer is less motivated to work hard on the farm, which results in low output and other issues including financial stress (Ahmad *et al.*, 2013).

2.21. Non-utilization of cultivable wasteland: A larger portion of Pakistan's overall agricultural land is composed of cultivable wasteland. As a result of the population's rapid growth, less land is being made available per person, mostly because Baluchistan's cultivable wastelands are not being used (Bhutta, 1999). The Pakistani government made an effort to give students studying agriculture cultivable wasteland, but land-holding organizations prevented the government from moving further with the proposal (Soomro, 2011).

2.22. Use of adulterated or expired insecticides: Despite official claims that it has reduced pesticide adulteration below 1%, there is a persistent trend toward the use of inferior pesticides (Daily Times, 2012) Due to their long-lasting residual effects, low-quality pesticides harm the environment and can potentially cause some very serious health problems (Jabbar and Mallick, 1994). Additionally, there has been a shortage of high-quality insecticides during the peak season, and the market is dominated by vendors selling adulterated or out-of-date pesticides, both of which are harmful to Pakistan's general economic development and the sustainability of its agriculture (Dawn, 2013).

3. Strategies to solve the issues/problems

3.1. Save water to increase crop production: Water is lost in enormous amounts as a result of flow, infiltration, spillage, etc. Leakage ultimately leads to water dumping, which reduces the region's productivity. By obstructing the canals and channels, such losses can be eliminated (Ayub, 2020). Additionally, people need to be taught and educated on how to cooperatively conserve and use water (Adebayo, 2007). The nation should enact water management laws like several Western states do. Currently, groundwater outlets account for the second-largest share of all water sources. This supply has been utilized effectively by both public and private tube wells. It would still provide more water than 9 MAF. With appropriate discretion, this supply may be exploited for agricultural purposes, and it already is. However, excessive water extraction and tube

wells in some regions have caused rapid ground-water depletion.

Government officials must take control of these locations to prevent their depletion and use outlets to recharge them. 90% of Pakistan's food production, which accounts for 25% of the nation's gross domestic product, is watered by the Indus River basin, which also feeds water to the largest contiguous irrigation system in the world. However, Pakistan may experience severe food shortages that are directly related to water scarcity. By 2025, it is predicted that there would be a 32% gap in water requirements, leading to 70 million tons of food shortage. By 2025, it is predicted that the siltation of major reservoirs and climate change would have reduced the capacity of surface water storage by 30%. Comparatively speaking to other nations, Pakistan has a far lower per-person water storage capacity at only 150 m³. Irrigated agriculture will be significantly impacted by this decline in surface supplies and ensuing cutbacks in groundwater abstraction. There won't be as many supply-side solutions accessible as there were in the past to provide additional water (Bashara, 2019; Ahmad, 2011; Nasir *et al.*, 2012).

To improve the water resources, there are several options accessible. For example, building small dams, promoting high-efficiency irrigation systems, leveling the ground precisely, and implementing integrated farm management methods are some of the outstanding and practical solutions.

3.2. Water logging and salinity control and construction of dams: The sustainability of irrigated fields and the livelihoods of farmers, particularly smallholders, in the afflicted portions of the Indus Basin are severely hampered by waterlogging and salinization. Numerous causes, such as seepage from unlined clay canal systems, insufficient surface and subsurface drainage, poor water management techniques, insufficient water supply, and the use of subpar groundwater for irrigation, contribute to these issues. The salinity can be controlled by the applications of various engineering strategies (Qureshi *et al.*, 2008; Sahabet *al.*, 2021; Choudhary 2016).

In Punjab and Sindh, water logging and salinity obliterate roughly one million acres of land each year. Our cultivable area is reduced. Tube well installations, canal bank repairs, water drainage, etc. are required for this purpose. The goal of the Rs. 18.5 billion investment planned by the Ministry of Agriculture is to install drip and shower irrigation on 2, 00,000 acres of irrigated land. Heavy unwelcome rains and flooding can occasionally ruin agricultural productivity.

Building dams and bunds on rivers are important to address this issue.

3.2.1. Crop rotation and precise land leveling: Crop rotation is a tool that can be used to conserve water, boost soil fertility, and stop soil erosion in both the current and future climates. It was recommended to use five crop rotations on soil compromised by salinity in various countries. The crops used for these rotations are either sensitive or medium tolerant of salinity, or tolerant cultivars were chosen from those. It was advised to level the soil precisely and cultivate in raised beds to save 25% of the water used for surface irrigation.

The salinity can be minimized by crop rotation. Farmers should grow those varieties that show tolerance to salinity. The main crops which should be planted to reduce soil salinity as suggested by many researchers are rice, sugar beet, cotton, and sorghum. The crops that should be planted as rotating crops and have the tolerance to salinity are given in table 2.

Table -2: Cropping schedule envisioned for land reclamation

Duration	Winter	Summer
First-year	Barley/ryegrass/clover	Sorghum/rice
Second year	Wheat/clover	Cotton/rice
Third year	Clover/wheat	Rice/cotton
Fourth-year	Clover/beans/wheat	Rice/cotton/corn

Gehad (2003) and Ouda *et al.* (2016)

3.3. Supply of Agriculture Credit and prices of agricultural productivities: Our farm-ers occasionally obtain low prices for their pro-duce. There is no proper, effective government price policy. To raise the farmers' level of living, the government should provide fair pricing for agricultural products. Poor farmers in Pakistan cannot afford expensive technology with their own money. Therefore, it is imperative to provide easy terms and conditions for agricultural loans (Ahmad *et al.*, 2013).

3.4. Agro-based industries and the establishment of high-yielding varieties Poultry, fisheries, dairy products, and livestock should all become agro-based enterprises. These sectors help the agricultural industry indirectly. In Pakis-tan, high-yielding variety seed is not offered at a reasonable price. Farmers must rely on poor-quality seeds, which reduce overall productivity by 20%. In this situation, the government should offer HYV seed at a reduced cost (Ahmad *et al.*, 2013).

3.5. Agricultural research and mechanization:

To improve the agriculture industry's state of sluggishness, agricultural research is required. There are only 16 or so major agricultural institutions and universities in Pakistan. The government ought to conduct more agricultural research. Farm mechanization is required to solve the issues facing the agricultural sector. Crop production is improved by using agricultural machinery for sowing, growing, and harvesting. It is necessary to adopt farm mechanization that is specific to the local environment. For example, bulldozers and laser land levelers must be used in areas where large-scale land leveling is necessary, while in other locations, productivity can be increased by using conventional techniques like careful seedbed preparation and the use of high-yielding varieties of seed. Where canal water is not available, those areas must also be given priority to develop tube wells at a discounted rate, and solar tube wells are an excellent option for this. Proper irrigation and fertilization are also important (Ali *et al.*, 2019). The option to increase farm mechanization while keeping private ownership is cooperative farming. Since it can only rent and sell farmer's farm equipment at subsidized rates, the government bears the greater share of the obligation. However, statistics on the manufacturing and sales of a variety of agricultural machinery, including multipurpose tractors, potato diggers, soil levelers, pit diggers, tillerdrills, water sprinklers, and others, are scarcely available in the country (Aziz *et al.*, 2021; Iqbal *et al.*, 2015).

Comparative to industrialized nations and many other emerging nations with comparable resource bases, Pakistan's production in a variety of agricultural sub-sectors remains fairly low. Another argument is that Pakistan's economy will become more and more entwined with the global economy, making it harder for the country's agricultural industry to compete on a global scale unless a higher increase in agricultural production is guaranteed on a sustainable basis.

3.6. Permanent Raised Bed Cropping Systems in Pakistan: According to Akbar *et al.* (2007), a permanent raised bed cropping method could be used to increase yield while also saving water during field application. For both irrigated and dry land locations, permanent raised beds are commonly employed in many countries. A 20–100% increase in production was accomplished in irrigated and dry lands. Early studies carried out in Pakistan have demonstrated that non-permanent beds/ridges and furrow irrigation increased wheat yield by 20–25% (Iqbal *et al.*, 2022). A similar rise

in cotton and canola yields of 17–48% and 45%, respectively, was found with water savings of 25–50%. In an experiment on the wheat-maize cropping pattern from 1999 to 2004, Hassan *et al.* (2005) used permanent raised beds (180 cm between the centre of furrows) as opposed to flat basins in Mardan, NWFP, Pakistan. They found that the yield increased by an average of 30% for maize and 13% for wheat in permanent raised beds, water was saved by an average of 32% for maize and 36% for wheat, water productivity increased by an average of 65% for maize and 50% for wheat.

3.7. Applications of nutrients to the soil: Not only can these soil micronutrient deficits reduce crop output, but they also lower the quality of the products. Human health risks are caused by the high intake of foods made from cereal that are poor in micronutrients. It is possible to increase the number of micronutrients in food through supplementation, fortification, or agricultural methods including biofortification and the use of fertilizers that contain micronutrients. Food fortification and supplementation are prohibitively expensive, impractical for widespread use, and difficult for the underprivileged to get. The creation of genotypes that are micronutrient-efficient can be a step-by-step method for resolving soil micronutrient problems and enhancing human health.

The field harvesting of wheat fortified with micronutrients would, however, mine out more micronutrients. The cultivation of these genotypes can be combined with the use of fertilizers rich in micronutrients. Such fertilizers will be added, which will not only make up for deficiencies but also increase crop yield and fruit quality. For better crop productivity, 2 to 5 kg of Zn per hectare may be sufficient; however, soil-applied Fe is typically useless, except for Fe-sequestrate. Ferrous sulfate (FeSO₄) or chelated Fe repeated sprays cure chlorosis and enhance food quality.

3.8. Natural gas availability in the fertilizer sector: Since natural gas is the only raw material used in the fertilizer business, there is a demand for discounted gas to be supplied to this industry. To lower the cost of a fertilizer bag, fertilizer businesses are requesting that a consistent gas supply be made available (Tribune, 2012). The Iran-Pakistan Gas Pipeline Project's recent success will help the fertilizer industry's need for natural gas even more (The News, 2013).

3.9. Controlling the smuggling of agricultural products: Border patrol intervention and nationwide security checks can aid in resolving

this problem (Tribune, 2012). Now, the Pakistani government is also taking some significant steps to encourage the cross-border movement of agricultural products, particularly wheat, to boost supply at stable price levels (Dawn, 2013).

3.10. Strengthening research extension bond: The merger of the extension department with various research institutes and universities should come once the extension department has been privatized. The cultivable wasteland and a goal should be provided to the students. New research-based performance-based farming should be supported, and farmers that perform well and increase yields by implementing new technologies should receive incentives (Ahmad *et al.*, 2013).

Conclusion and recommendations: Pakistan is an agro-based nation, and issues with this important sector threaten both the national economy and the country's geopolitical position. The lack of interest from higher authorities in this crucial industry makes the current scenario dangerous in the long run. Adopting the useful advice provided in this assessment will undoubtedly raise Pakistan's Agricultural GDP. Pakistan's economy is still developing in the agricultural sector despite being an agrarian nation. To solve all the issues facing the agricultural industry, modern techniques, the supply of financing facilities, basic infrastructure, and agricultural research facilities are required.

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