
The Urban Unit
Urban Sector Planning & Management Services Unit (Pvt.) Ltd.
AGRICULTURE
DEVELOPMENT
PLAN

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EXECUTIVE SUMMARY

Agriculture is the backbone of Pakistan's economy, and while its contribution to the GDP has decreased, it still plays a significant role in the country's socio-economic framework. With 60% of the population residing in rural areas and relying on agricultural activities for their livelihood, Punjab is a major contributor to agriculture, with crops such as wheat, cotton, rice, sugarcane, citrus, oilseed, and various fruits and vegetables being grown. However, the Faisalabad division is responsible for the largest share of agricultural production in Punjab. Despite a favorable growing environment, declining yields and livestock productivity persist due to water shortages, soil fertility decline, water quality degradation, and limited agricultural areas. Interventions by the government have failed to produce a significant increase in productivity due to a lack of focus on the comparative advantage of each area and value chain development approach.

However, the Faisalabad division faces severe productivity and inefficiency problems due to a lack of modern water distribution infrastructure, limited access to modern farming methods, machinery, transportation, storage facilities, electricity, inputs, and improved seeds, as well as low-value addition in high-value crops. The proposed investment projects, which include ongoing and new projects, are divided into different phases based on their relative order in the value chain, and their priority is determined accordingly.

To improve productivity, a regional plan for agriculture development is being implemented, with a focus on specific zones for cultivating major and high-value crops, accompanied by targeted infrastructural support. The Faisalabad region plan aims to diversify and transform subsistence agriculture into high-value export-oriented agriculture through an integrated planning approach. The plan identifies and specifies clusters/zones for each crop based on agroecological conditions, and 16 crops have been recommended for the Faisalabad region. Interventions such as the provision of certified seeds, specialized extension services, quality inputs, mechanization, packaging, storage, transport, harvest, post-harvest management, and market development will be implemented in a phased manner to optimize the agricultural value chain. Incentives will be provided to farmers for the adoption of the selected 16 crops, and high-value cropping zones have been identified to maximize yields.

1. CHAPTER

1.1 INTRODUCTION

The agriculture sector contributes 22.7% to the GDP and generates 37.4% of the employment of Punjab's Labour force (Economic Survey, 2021-22). This sector comprises crops, livestock, fishing, and forestry. During 2021-22, agriculture sector recorded a remarkable growth of 4.40 percent and surpassed the target of 3.5 percent and last year's growth of 3.48 percent. This growth is mainly driven by high yields, attractive output prices and supportive government policies, better availability of certified seeds, pesticides and agriculture credit. The crops sector outperformed and posted a growth of 6.58 percent during 2021-22 against 5.96 percent last year. The growth in production of important crops namely cotton, rice, sugarcane and maize are estimated at 17.9 percent, 10.7 percent, 9.4 percent and 19.0 percent respectively. Other crops having share of 13.86 percent in agriculture value addition and 3.14 percent in GDP, grew by 5.44 percent on the back of increase in the production of pulses (29.82 percent), oilseeds (24.75 percent), vegetables (11.52 percent), fruits (1.53 percent) and fodders (0.36 percent).

However, the agriculture sector of Pakistan and Punjab as well suffers from low productivity due to poor quality and inadequate agriculture inputs, poor farm management practices, limited availability of key agriculture inputs to the subsistence farmers due to limited knowledge, and high cost, and limited accessibility. Small farmers are unable to make use of modern machinery due to their poor economic conditions and high cost of technology. Although large farms do use machinery and equipment, they are unable to match international production standards. Therefore, the share of agriculture in total GDP has been declining since independence in 1947. Agriculture contributed more than 50 percent to GDP in the 1970s. Moreover, compared to major crops, livestock had a smaller contribution in the 1970s.

1.1.1. PRODUCTIVITY COMPARISION OF AGRICULTURE SECTOR

Agriculture is the foundation of the Punjab economy. Moreover, the agricultural sector's growth has been hampered by shrinking arable land, climate change, water scarcity, and a large-scale population and labour shift from rural to urban areas. The rising cost of inputs such as fertilisers, pesticides, and seeds is yet another point of concern for crops. Early-generation seeds are rare and

expensive, and preliminary research to develop new varieties resistant to pests, diseases, and climatic pressures is inadequate.

Figure 1 compares yields of some important crops in the Faisalabad region to progressive farmers and international best yields. Despite advances, a significant productivity gap has been observed in all crops when compared to the global average. It has also been observed that the gap between progressive farmers in Punjab and Punjab average farmers is very large, indicating potential otherwise.

This reflects the goal of increased agricultural productivity, which could be achieved throughout the Faisalabad Division by investing heavily in agricultural research and extension systems, accelerating the diffusion and adoption of the latest agricultural and irrigation technologies, and improving inputs use, irrigation water management, reclamation, and drainage to increase productivity in the proposed crops.

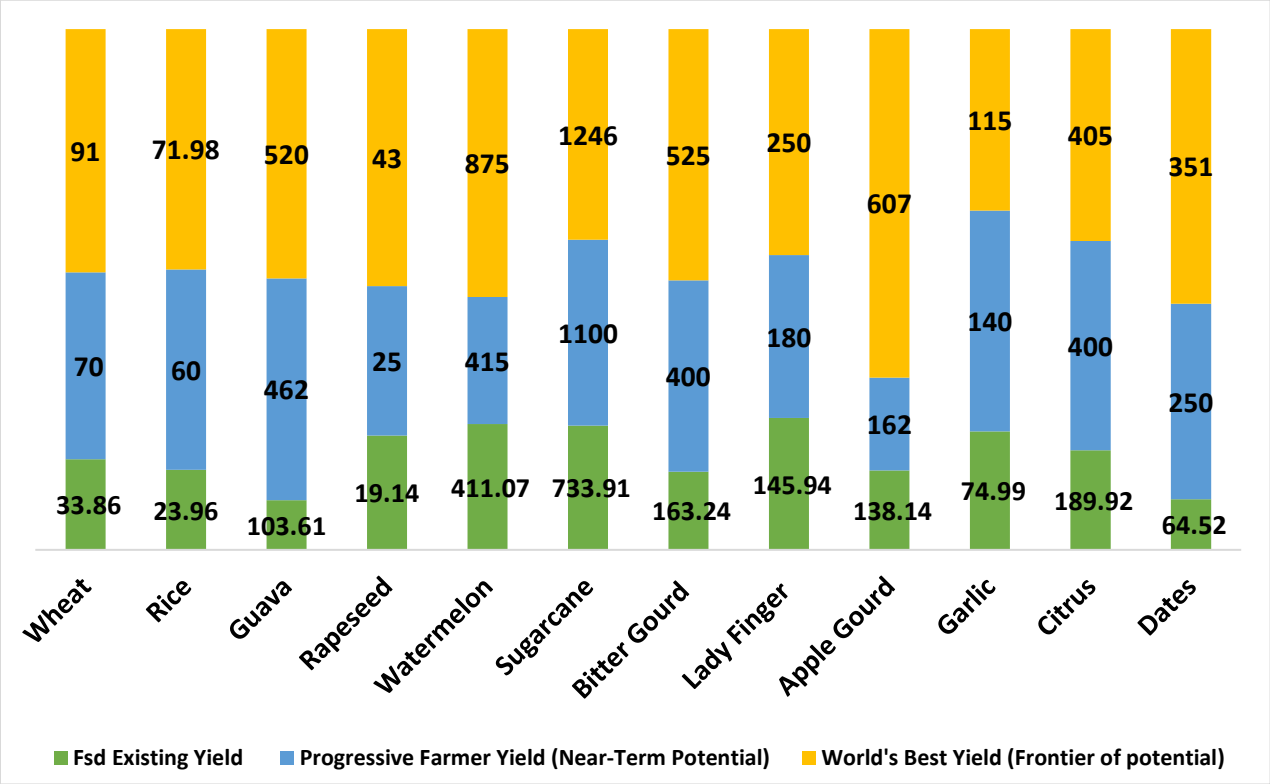


Figure 1: Yield Comparisons (Mund/Acre)
Source: FAO and Crop Reporting Service

1.1.2. ENABLING THE BUSINESS OF AGRICULTURE

Policymakers can use Enabling the Business of Agriculture to assess the agricultural regulatory environment. (World Bank, 2019) investigates whether government-designed regulations and processes benefit or harm domestic farmers' agricultural activities. It includes components for tracking performance and identifying barriers to agricultural market integration and innovation. The study employs eight indicators drawn from a wide range of agricultural data. The Agriculture Enabling Business score is strongly linked to broader development outcomes. Countries with better regulation, as measured by the ability to conduct agricultural business, have lower poverty rates on average. It implies that higher productivity efficiency gains translate into higher farm income and more job opportunities for the rural population. However, as shown in Figure 3, Pakistan ranks 68th out of 101 countries, and needs to improve the enabling environment for faster growth in the agriculture sector.

Figure 2: Enabling the Business Of, Agriculture Indicators
Source: Enabling the Business of Agriculture 2019

RANKING	COUNTRY	SCORE
1	France	93.7
2	Croatia	92.68
3	Czech Republic	92.32
4	Hungary	91.77
5	Spain	91.71
12	Brazil	75.25
55	Malaysia	51.68
57	Mexico	69.46
40	India	62.23
99	Vietnam	61.41
68	**Pakistan**	**48.87**

Figure 3: Enabling the Business of Agriculture
Source: Enabling the Business of Agriculture 2019

1.1.3. GLOBAL WATER PRODUCTIVITY GAP

The next problem of water availability is associated with the agriculture sector which is of immense importance. Water is essential for irrigation in agricultural production and has been an ongoing issue in recent times, not only in Pakistan but also all over the world as the shortage of water can affect the national economy very badly. Pakistan has one of the largest irrigation systems in the world with more than fifty million acres of irrigated land but unfortunately, water productivity in Pakistan as well as in Punjab is very low.

The figure 4 provides information on the water productivity of four countries, which is the amount of crop or livestock output that is produced per unit of water used in agriculture, measured in kg/m3.

Looking at the table, we can see that the United States has the highest water productivity at 1.56 kg/m3, followed by China at 0.82 kg/m3. Pakistan has the lowest water productivity at 0.13 kg/m3, and India falls in between with a water productivity of 0.39 kg/m3.

It's worth noting that water productivity can be influenced by a variety of factors, including climate, soil quality, and agricultural practices. Therefore, this table provides only a limited view of the agricultural water productivity of these countries and should be interpreted with caution. Nonetheless, it does suggest that the United States and China have been relatively successful in maximizing the output they get from the water used in agriculture, while Pakistan may have room for improvement.

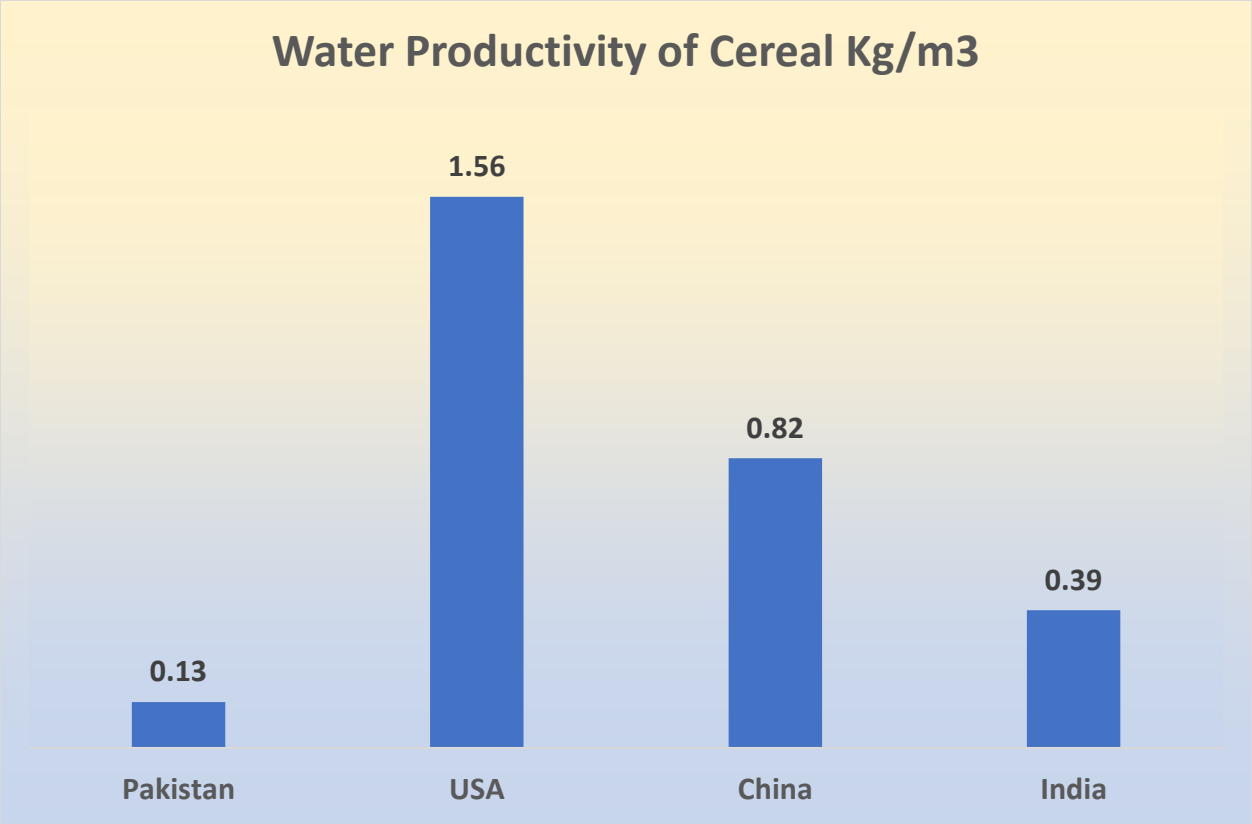


Figure 4: Global Water Productivity Gap
Source: (INP, 2019)

1.1.4. TOTAL FACTOR PRODUCTIVITY GAP

Total Factor Productivity (TFP) in agriculture is currently the lowest in the region, and it has been declining since the 1980s, when Pakistan's agriculture was at its peak. It is not only low and declining due to large variations across regions and farm size, whereas TFP has been stagnant. However, growth is directly related to increased input use rather than technological advancement or modern practises. A lack of new seed varieties, pest resistance to existing pesticides, stagnant irrigation methods, decreasing soil health as a result of poor farming practises, deficiencies and imbalances in fertiliser use, and a failure to leave the land fallow are all factors contributing to this decline.

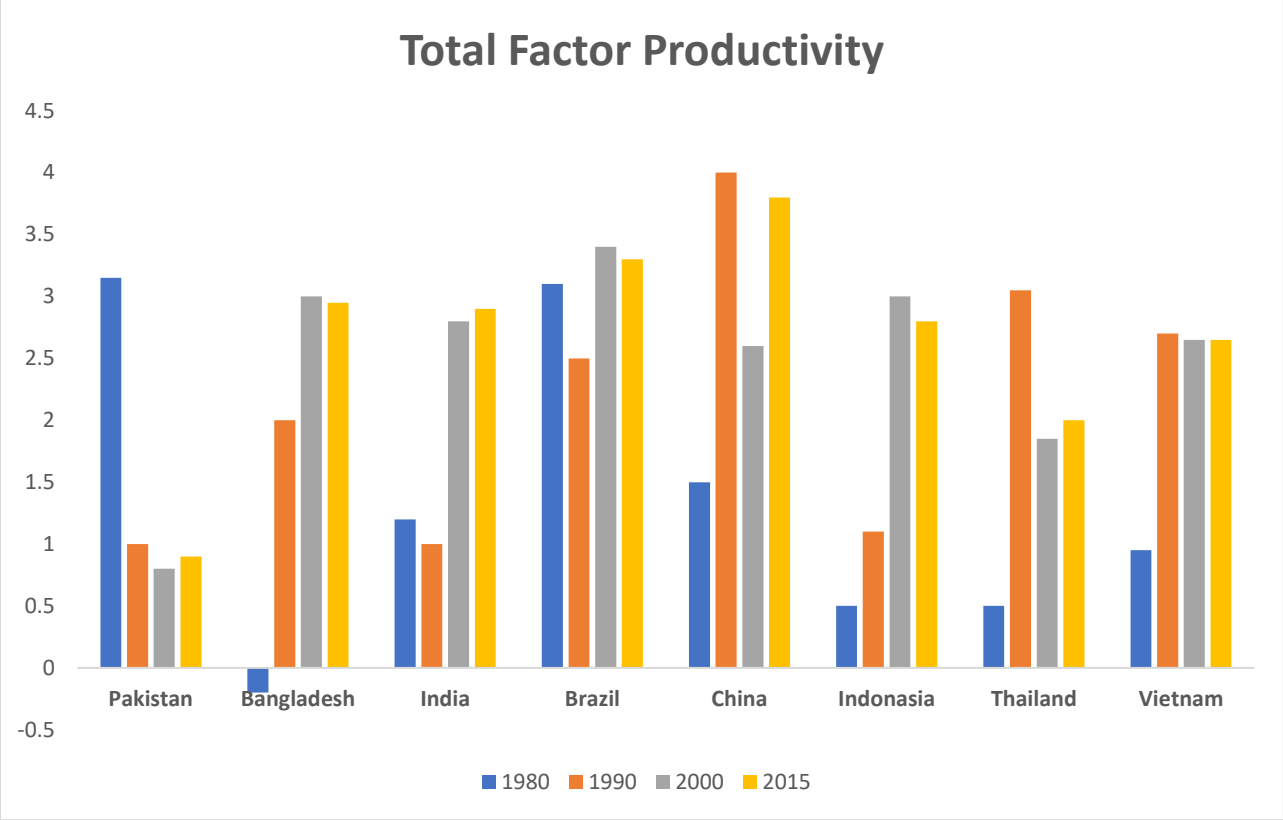


Figure 5: Total Factor Productivity Since The 1980s
Source: Agriculture Sector Plan 2015

The problems highlighted above about the global water productivity, and factor productivity described that the agricultural sector is critical to the growth of the economy, food security, job creation, and poverty alleviation, especially in rural areas. Therefore, increased agricultural productivity is central to sustainable economic growth, alleviating poverty, and ensuring food security.

1.1.5. AGRICULTURE, FORESTRY, AND FISHING, VALUE-ADDED PER WORKER (CONSTANT 2015 US$)

A measure of agricultural productivity is agriculture value added per worker. In agriculture, value-added is defined as the output of the agricultural sector less the value of intermediate inputs. Agriculture includes the value added by forestry, hunting, and fishing, as also crop cultivation and livestock farming. Argentina ranks first in the world in terms of agricultural value-added per worker. Argentina's agriculture value added per worker in 2019 was 2.76 million US dollars,

accounting for 50.19 percent of global agriculture value added per worker. The top five countries (Iceland, Canada, Singapore, and Norway are the others) account for 58.52 percent of it. However, in 2019, the total agricultural value-added per worker was estimated to be 5.5 million US dollars. In addition, South Asia's agriculture value added per worker in 2019 was 1.99 million US dollars while that of Pakistan's agriculture value added per worker was 2.63 million US dollars 2019.

The data on the value-added per worker in the Agriculture, Forestry, and Fishing sector across the selected countries reveals some interesting insights.

Firstly, it is apparent that the value-added per worker is quite low in the South Asian region, including countries like India and Pakistan. This could be due to several reasons, such as the low use of technology, poor infrastructure, and limited access to credit and market information for farmers.

In contrast, Turkey, China, and Brazil have much higher value-added per worker in this sector. This could be due to several factors, such as higher mechanization, the use of modern technology and techniques, better access to financing and market information, and a more developed value chain.

Overall, the data highlights the significant differences in the productivity and efficiency of the Agriculture, Forestry, and Fishing sector across different countries, and suggests that there is significant scope for improvement, particularly in the South Asian region.

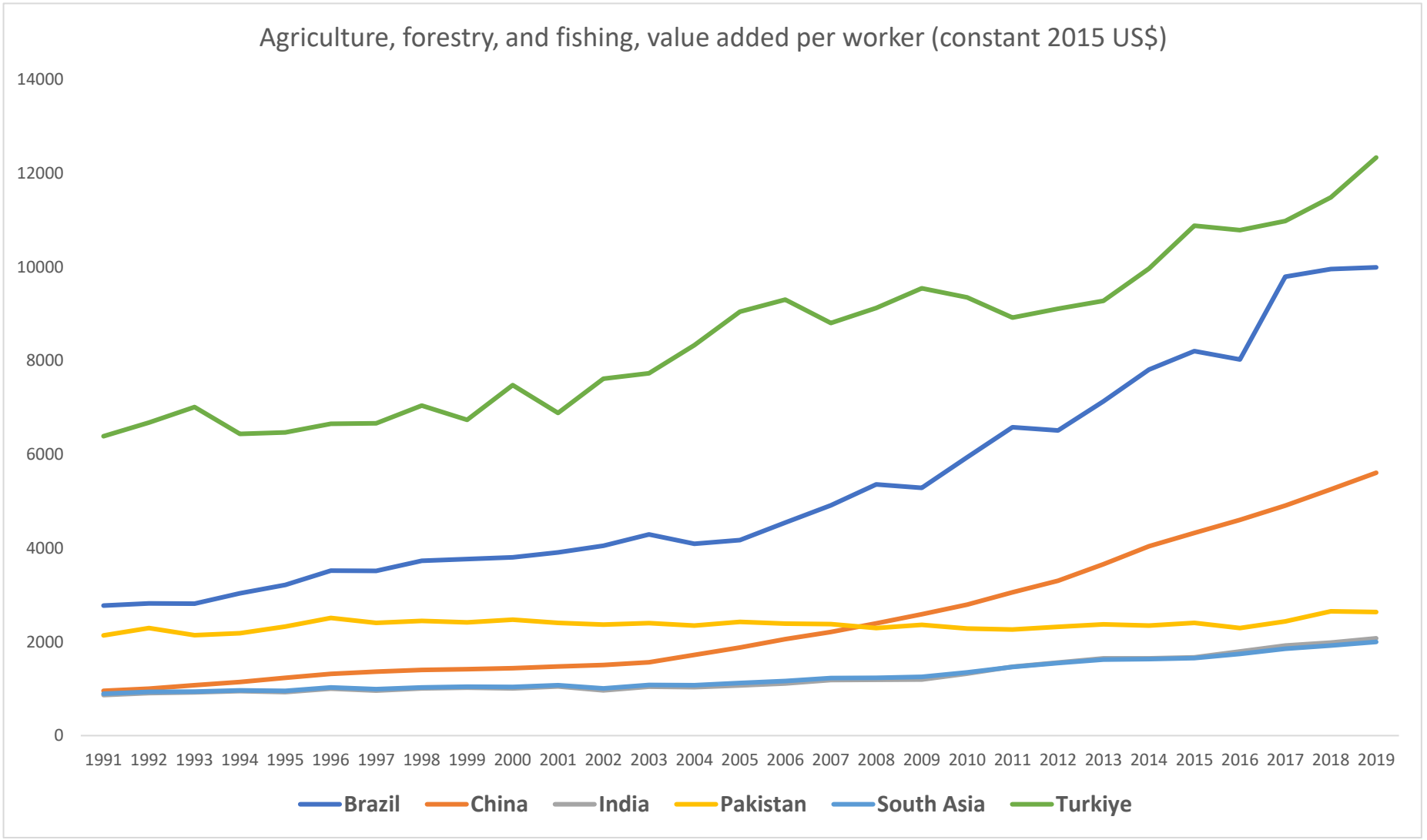


Figure 6: Agriculture, Forestry, And Fishing, Value-Added Per Worker (Constant 2015 US$)

Source: World Bank

1.2 ISSUES AND CHALLENGES OF AGRICULTURE

Pakistan's agriculture sector is faced with several issues and challenges, including water scarcity, land fragmentation, lack of mechanization, an inefficient supply chain, limited access to finance, and the impacts of climate change. These challenges have led to decreased agricultural productivity, increased costs, and limited the sector's ability to compete in the global market. Addressing these challenges requires policy reforms and investment in research and development, infrastructure, and modern technologies, among other things, to increase productivity, efficiency, and competitiveness in the agriculture sector.

1.2.1. CHALLENGES IN SUSTAINABLE AGRICULTURE

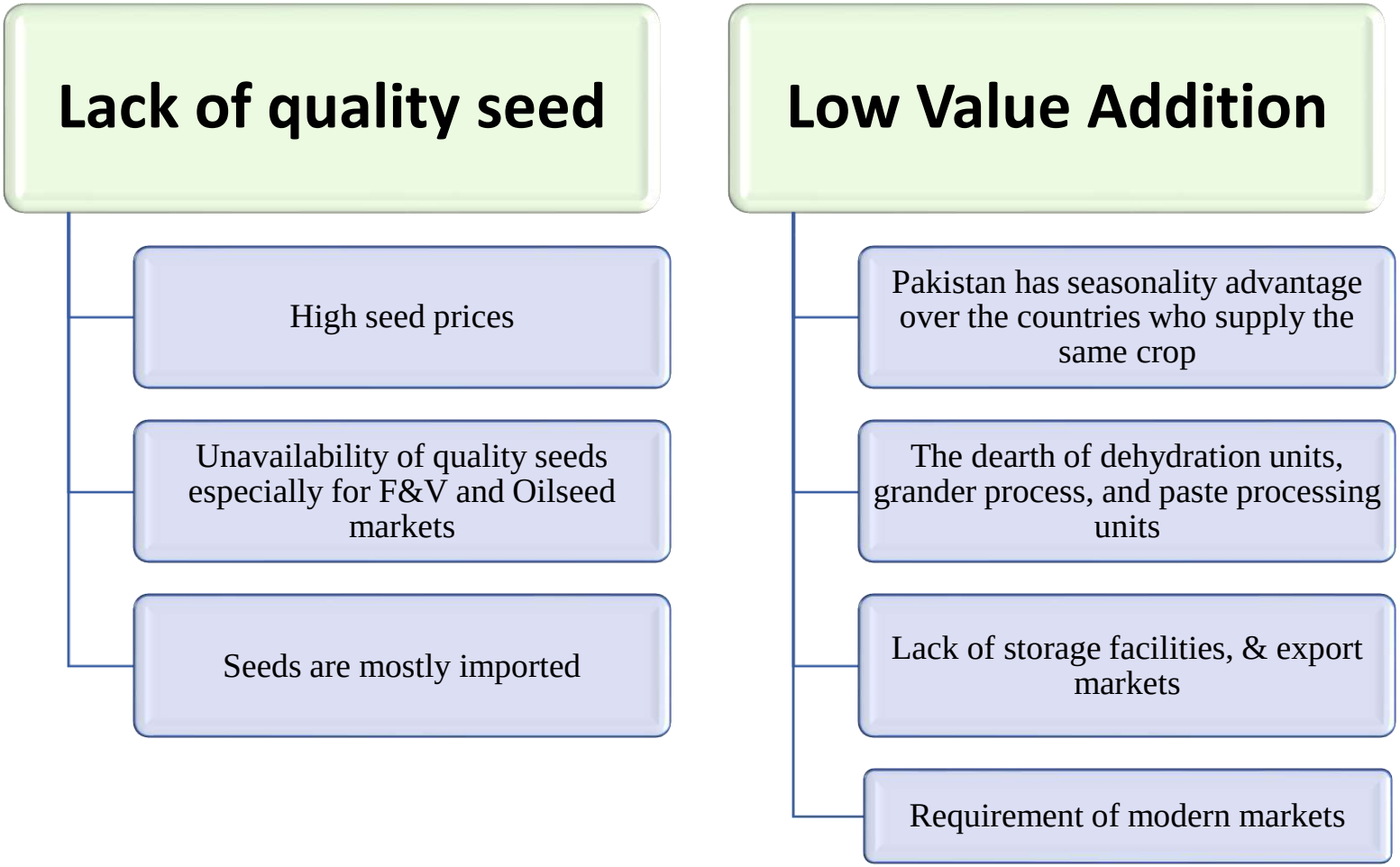
The current issues and challenges in the agriculture value chain in the Faisalabad region can have significant impacts on the agricultural sector, including reduced productivity, decreased farmer incomes, and a lack of competitiveness in the global market. However, some common issues and challenges found after the ground assessment are following:

Labor Shortage

- Labor shortage along the cities due to a huge shift towards the industrial sector
- Urbanization is occurring as a result of a decrease in agricultural areas, particularly fruits and vegetables (peri-urban areas, especially along the 3 big cities Faisalabad, Jhang, & Toba Tek Singh)
- Causing difficulty for harvesting purposes, & simultaneously increasing the cost of production

Climate Change

- Disrupting food availability has decreased the productivity of crops especially wheat and guava which got severely affected last year
- Increases the incidence of pests and diseases
- Cropping pattern & cropping season is changing drastically


Lack of quality seed
High seed prices
Unavailability of quality seeds especially for F&V and Oilseed markets
Seeds are mostly imported
Low Value Addition
Pakistan has seasonality advantage over the countries who supply the same crop
The dearth of dehydration units, grander process, and paste processing units
Lack of storage facilities, & export markets
Requirement of modern markets

Overall, addressing these issues would require a combination of policy measures, investment in infrastructure and technology, and education and training programs for farmers. Encouraging sustainable farming practices and investing in research and development to improve crop and livestock productivity would also be beneficial. Additionally, government and private sector partnerships to support farmers, improve market access and increase access to finance for farmers and rural communities could help to mitigate these issues.

As a result, all of the aforementioned factors have reduced Faisalabad's competitiveness in global markets. Even though lower farmgate prices in the Faisalabad region give traders a comparative advantage, these lower price differentials are typically due to poor-quality produce. Optimizing agricultural produce quality to global standards is the most difficult challenge to improving Pakistan's competitiveness in national and global markets.

In conclusion, factors impeding agricultural progress include suboptimal irrigation water distribution and an absence of efficient clusters of high-value crops, a lack of timely adoption of new techniques and innovation, policy distortions, and insufficient marketing development. Addressing these challenges will require a comprehensive approach that includes investments in infrastructure, the development of new technologies and best practices, and the creation of supportive policies that promote sustainable agriculture. This will help to increase productivity, improve farmer incomes, and enhance the competitiveness of the agricultural sector in the global market.

1.3 COMPREHENSIVE AGRICULTURE TRANSFORMATION PLAN

Keeping in view the problems, the Government needs to focus simultaneously on three broad strategies, the first one being to identify the potential areas for each crop and make clusters/zone of each crop and provide all facilities and specialized support systems for each crop in cluster/zone particular to their needs. It will increase efficiency in the system (efficient use of resources like land, labor, water, inputs) and facilitate government to easily manage the whole value chain of each crop (management of inputs, extension services, technology, R & D, and providing subsidy).

Secondly, gradually shift crop-mix patterns from low-value crops to high-value crops by identifying potential areas of those crops. In this regard, identify some potential crops from high-

value crops on a priority basis for the next five years and to develop a complete value chain for those crops. Crops like Citrus, and Guava are identified based on profitability; demand; high potential for value addition; export, and comparative advantage in international markets for the upcoming five years ultimately resulting in the growth of the agriculture sector in Punjab. Lastly, the yield of major and other crops (other horticulture, food grain, oilseed, and minor crops) can be increased so that the production is achieved from a limited area and hence the remaining area is optimally utilized to produce high-value crops.

Punjab spatial strategy is a long-term spatial development framework for the province of Punjab, across all sectors including agriculture, livestock, irrigation, food, forestry, industries, environment, urban planning, and social development. The strategy aims to ensure integrated spatial planning by identifying the comparative advantage of each area that will structurally transform Punjab into an economically developed region.

Furthermore, in PSS a comprehensive agriculture transformation plan was prepared which focuses on the comparative advantage of each region/division of Punjab. In this regard, the Urban Unit has been given the task to devise a comprehensive agriculture development plan for the Faisalabad region which covers detailed agriculture and livestock plan by value chain of each potential/identified crop of the region.

1.3.1. REGIONAL PLANNING (SCOPE OF WORK)

The agriculture sector is one of the most important sectors of the economy of Punjab; an increase in agricultural productivity will make a massive contribution to increasing the growth rate of Punjab's economy. However, there is no spatial lens through which development projects can be assessed and evaluated for the targeted economic growth. Therefore, the Punjab Spatial Strategy focuses on the potential for economic growth in the agriculture of the province.

Considering the Punjab Spatial Strategy framework, the agriculture sector of Punjab must reposition itself to transform the agriculture sector in the province of Punjab to increase crop productivity, bring the additional uncultivated area under cultivation and improve the crop mix to create maximum value addition in the province to contribute towards inclusive economic growth. This would be done by transforming the farmers of Punjab into progressive farmers, equipping

them with state-of-the-art support and knowledge, providing them with quality and timely inputs as well as creating an enabling environment.

This work will be to develop and validate agro-ecological conditions and socio-economic profiling of agriculture and livestock sectors of the region focused on;

a. Assessment of physical environment (land cover, geology, natural resources, climate and meteorology, hydrology, population, land use, community social structure, etc) to determine optimal cropping pattern for intensification
b. Cropping pattern identification with yield, price, cost of production, profit per acre, etc
c. Proposed cropping pattern for intensification
d. Identification of problems in the product-level value chain (seed to market), resource, and financial constraints.
e. Proposing solutions and interventions at each stage of the value chain to enhance production and exports
f. Focusing on exportable surplus and finding value propositions for interventions leading to economic growth in the area
g. Water availability and utilization assessments for natural resource preservation
h. Economic activities (livestock and agro-based industries, employment, and labor market) assessments.
i. Key facilities assessments (agricultural markets, farm mechanization, breeding and seeding facilities, etc) for infrastructure and policy interventions

Therefore, the regional development plan for Faisalabad Division focuses on the need to change our current cropping pattern from low-value crops to high-value crops. So that farmer income is increased and the agriculture sector may flourish. This is achieved by making clusters of these high-value crops in the areas where we have a comparative advantage with respect to yield and productivity as well as suitable ecological conditions.

1.4 FAISALABAD AGRICULTURE SECTOR PLAN

1.4.1. VISION

The vision is driven by elaborating the policy areas, targets, key actions, and stakeholders in the Faisalabad division. The Agriculture Development Plan in the Faisalabad region focuses on;

"Efficient use of resources to enhance productivity and generate value addition in agriculture through improving the regional and country positioning in terms of attractiveness and competitiveness by leveraging existing natural endowments for the economic wellbeing of people, especially rural communities."

1.4.2. AGRICULTURE OBJECTIVES

The main objectives of the regional plan for the agricultural sector are:

01 ***Enhance the competitive position of the agriculture sector to capture global demand and cater to domestic demand through the modernization of traditional agriculture practices.***

02 ***Ensure food security by improving food quantity, quality, and nutrition diversity through higher yields, better crop mix, and farmer profitability.***

03 ***Enhance sustainability and resilience in the wake of climate changes by conserving agricultural resources through efficient use of land & water.***

04 ***Strengthen and promote private sector participation in agriculture value chains with increased investment, technology infusion, and resource management.***

05 ***Improving breed development, on-farm mechanisms, medical facilities, and providing high-quality nutritional feed for enhanced productivity.***

06 ***Contribute towards poverty alleviation and economic development of the province through the provision of an enabling environment and farmer support services.***

07 ***Strengthen local markets and price mechanisms and increase accessibility to the international market by adopting international standards and certification.***

1.4.3. POLICY FOCUS AREAS IN AGRICULTURE AND LIVESTOCK

To achieve the above-stated objectives, the following policy focus areas should be adopted strictly to increase the income of the farmer, improve their standard of living and bring overall development to the rural areas.

- Low productivity to high productivity (Lessening the productivity gap in all crops, livestock)
- Identify the potential areas for each crop and make a cluster/zone of each crop
- Provide all ancillary facilities and specialized support systems for each crop in the cluster/zone.
- Gradually shift crop-mix pattern from low-value crops to high-value crops (identifying potential crops from high-value crops on a priority basis for the next five years).
- Wasteful use of water to efficient use of water and develop 24 agriculture corridors along 24 main canals and focus on integrated rural development in these corridors.
- All Departments coordinate and implement integrated action plans by using the maximum agriculture potential.

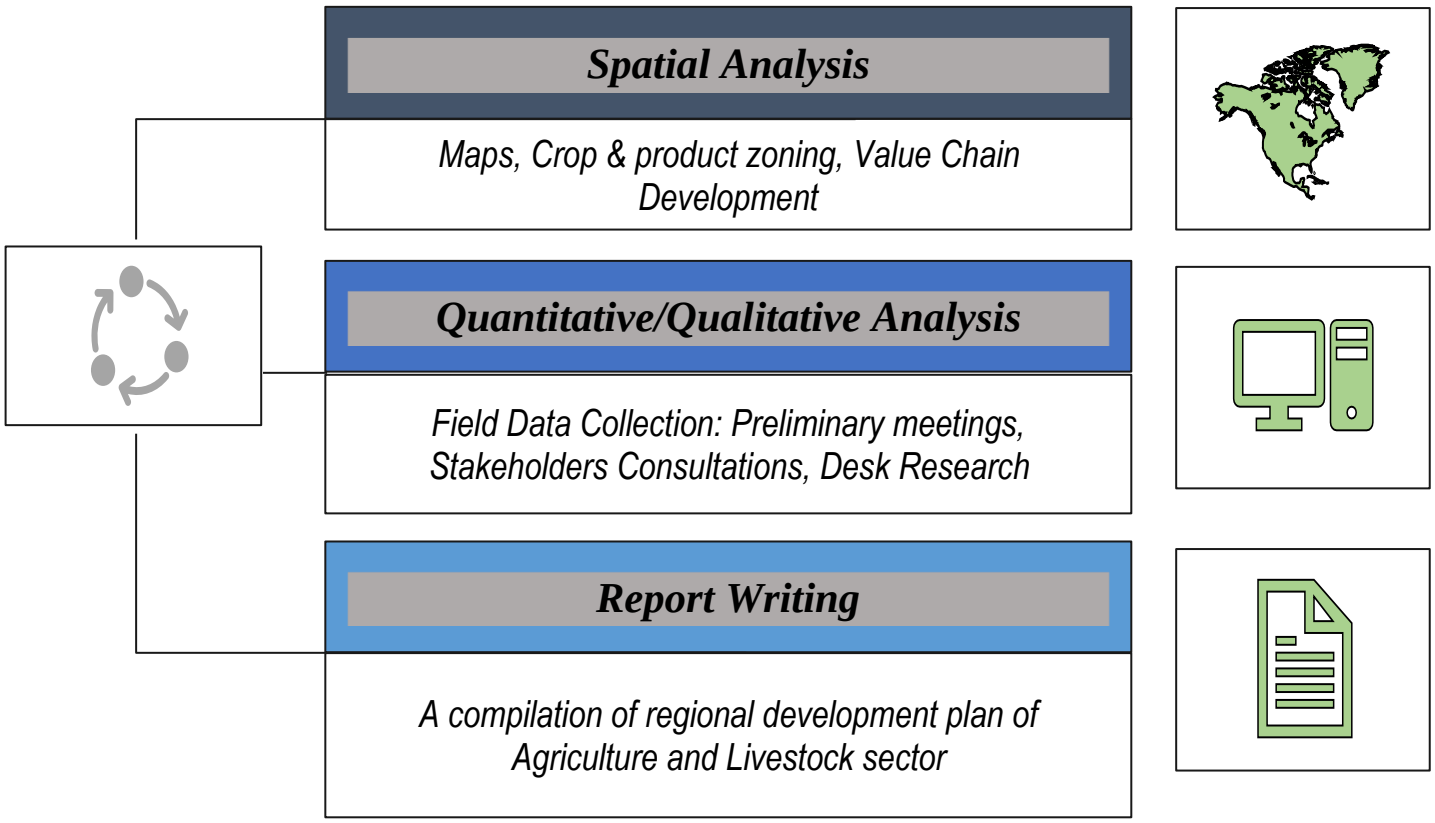
To achieve sustainable development of livestock, dairy, and meat processing sectors in the Faisalabad region, the following major policy areas are prioritized:

- Spatial zoning of the province for livestock production based on the locational advantages
- Nutritional values of soil, environmental and ecological conditions of each area shall be done
- And particular support services are provided for feed, fodder, silage, breeding, nursing, and disease control
- The area-specific coverage and results of extension services are also worked upon
- Supply chain management in the dairy, poultry, and meat sectors is improved and developed
- Market distortions are removed by implementing minimum farm-gate prices for milk and meat producers

- Capacity building of farmers (livestock producers) along with the institutional capacity building to address the market gaps across the value chain shall also be ensured
- R&D for breeding, disease control, and establishment of Disease-Free-Compartments
- Earmarking Areas for livestock processing industries in Industrial Zones and Estate

1.5 METHODOLOGY

This section provides detail about the methodology used for the analysis.

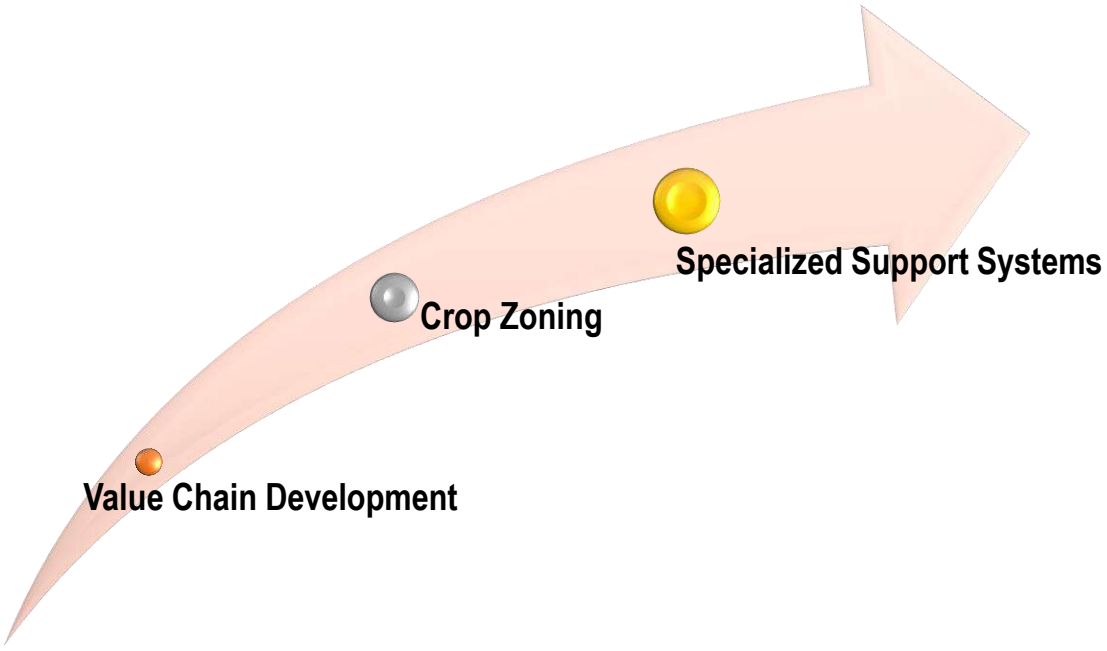


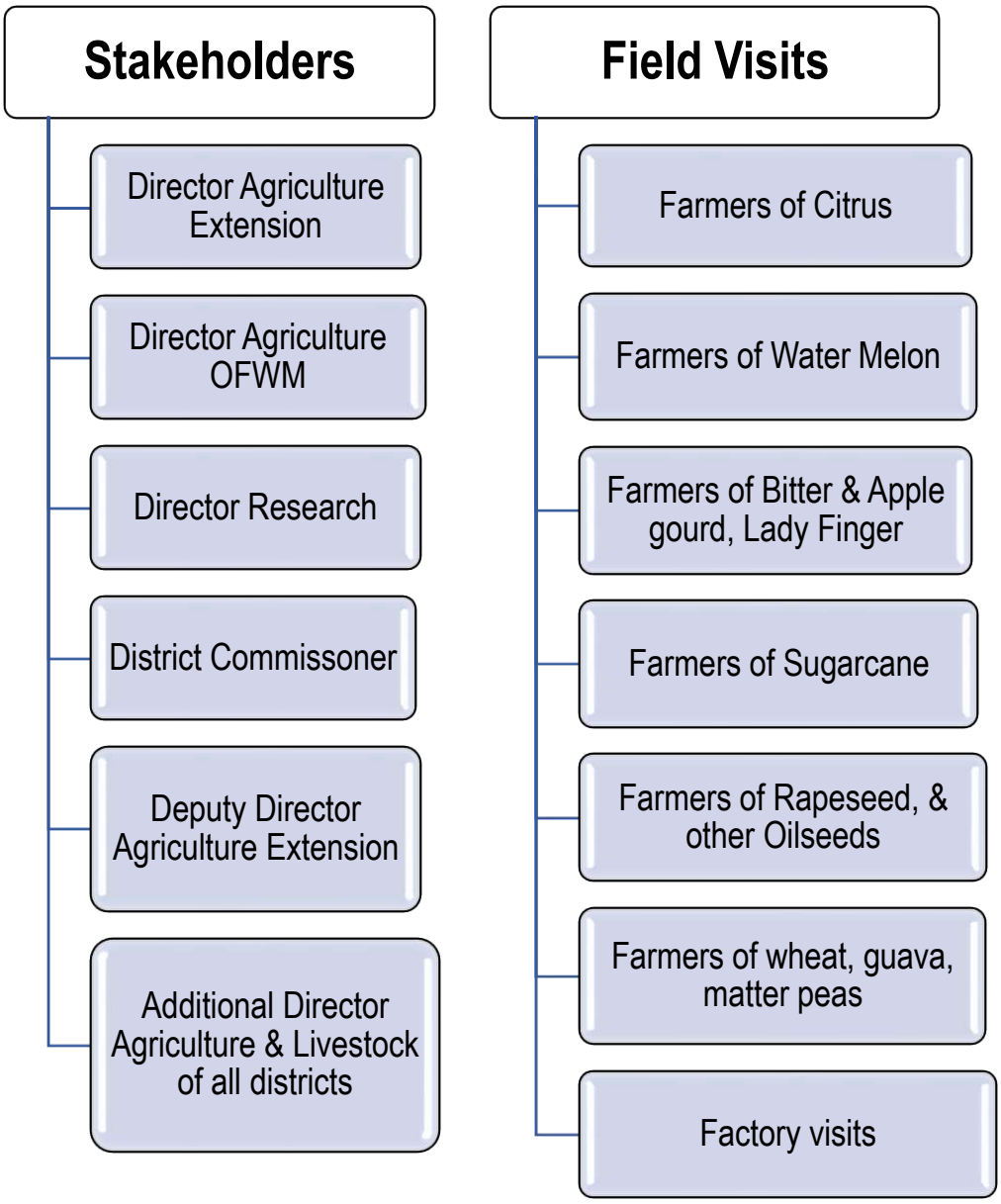
1.5.1. DATA ANALYSIS

Once the team collected the data, all of the information was then discussed and analyzed. The data was cleaned, integrated, and rechecked if any gaps were found in the collected data. Additional information was gathered from Agriculture and Livestock departments via email and telephone conversations. Based on the information collected in the field, the descriptive maps for the proposed Rabi and Kharif crops based on agro-ecological conditions were developed. Further analysis was then produced by the Agriculture and Livestock team.

1.5.2. IDENTIFIED POTENTIAL CROPS IN FAISALABAD DIVISION

The potential crops in the Faisalabad Division exhibit the importance of Value Chain Development through Crop Zoning and Specialized Support Systems which are considered the key strategies to improve the productivity and profitability of the region. Oilseeds are the newly identified high-value crops as recommended by the Research Institutes.




Stakeholders
Director Agriculture Extension
Director Agriculture OFWM
Director Research
District Commissoner
Deputy Director Agriculture Extension
Additional Director Agriculture & Livestock of all districts
Field Visits
Farmers of Citrus
Farmers of Water Melon
Farmers of Bitter & Apple gourd, Lady Finger
Farmers of Sugarcane
Farmers of Rapeseed, & other Oilseeds
Farmers of wheat, guava, matter peas
Factory visits

a. Rapid Assessments – Field Visits

The Urban Unit Agriculture & Livestock sector teams visited the Faisalabad division during two visits in November & December 2022

Meeting at Mamukajan

Meeting with DG Research

Field Visit of Jhang farms

Meeting with Jhang farmers

Field Visit

Papaya farms

1.6 FAISLABAD AGRICULTURE SNAPSHOT

1.6.1. PRODUCTION OVERVIEW

Major crops like Sugarcane, Rice, Maize, and Wheat contribute 29% and 13% respectively to the provincial share of Punjab from the Faisalabad division. Similarly, Oilseed crops such as Sesamum & Rapeseed & Mustard share 18% and 20%. The production of Vegetables & Fruits crops is also noteworthy. With the view to enhancing the production of the Faisalabad division, the government should introduce a specialized support system and introduce modern technology for the cultivation of high-value crops, while minimizing the utilization of input factors such as land, water, and labor. Based on the current pattern of crops, it is evident that the Faisalabad region is of immense importance and can significantly boost the production of these crops.

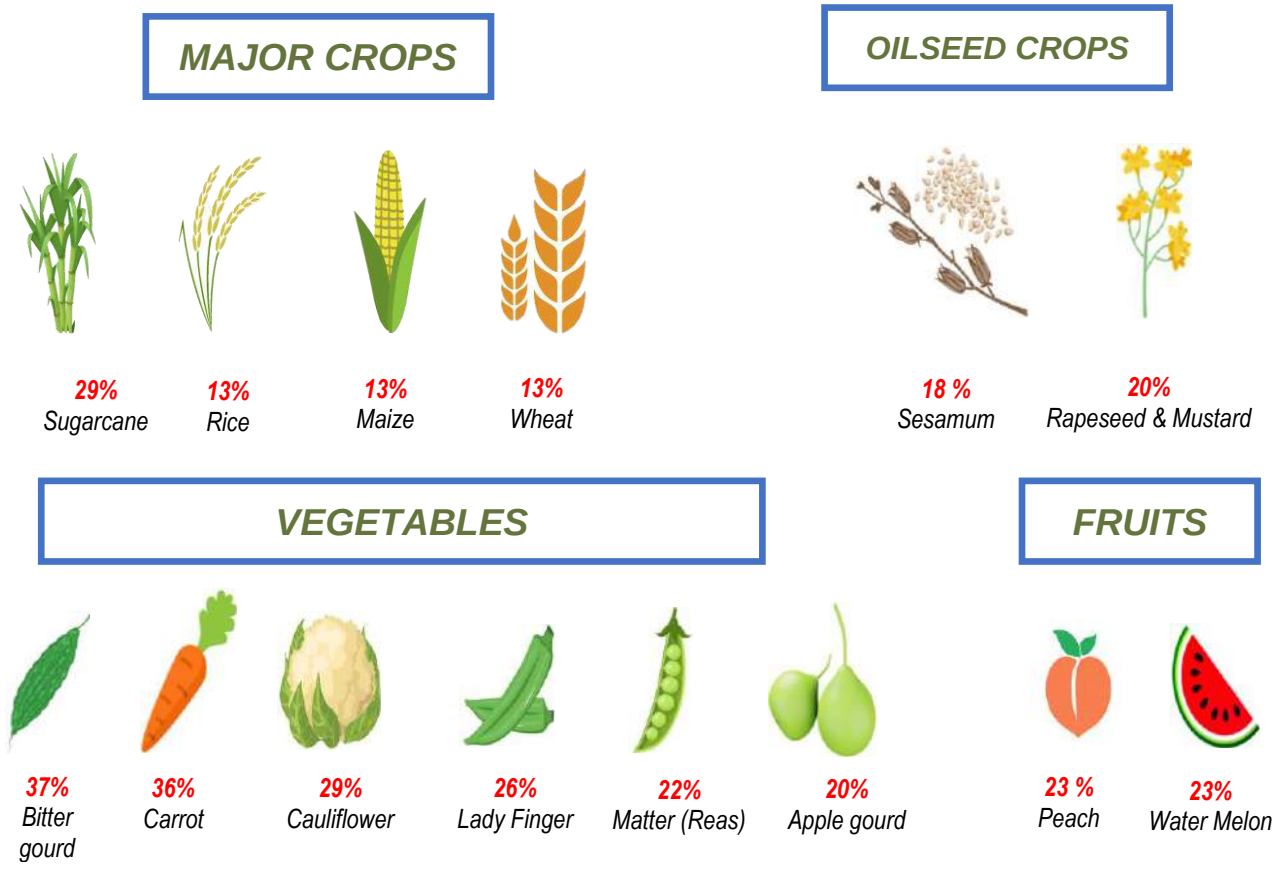


Figure 7: Percentage share of Punjab's crop produce from Faisalabad Division
Source: Crop Reporting Service

1.6.2. CURRENT CROPPING PATTERN

The Rabi and Kharif cropping patterns in the Faisalabad division of Pakistan refer to the seasonal cultivation of crops. Rabi crops are typically planted in the winter and harvested in the spring, while Kharif crops are planted in the summer and harvested in the fall. Some common Rabi crops grown in the Faisalabad division include wheat, barley, and gram. Some common Kharif crops grown in the Faisalabad division include rice, sugarcane, and maize.

Figure 8 presents the Rabi cropping pattern of the Faisalabad Division. It is demonstrated that wheat is the most important crop of this division of the Rabi season and is grown on 1.9 million acres, while the total Rabi area of this region covers 3,101,842 acres of land. Unfortunately, 1,322,696 acres remain uncultivated due to water scarcity and unfavorable soil conditions. Additionally, it is observed that the majority of the cultivated area is occupied by low-value crops, and the area under cultivation of high-value crops is negligible. For this reason, the Faisalabad Division yields only Rs. 50,000/ acre output in Rabi despite having abundant resources of land, water (ground & surface), and labor in this region.

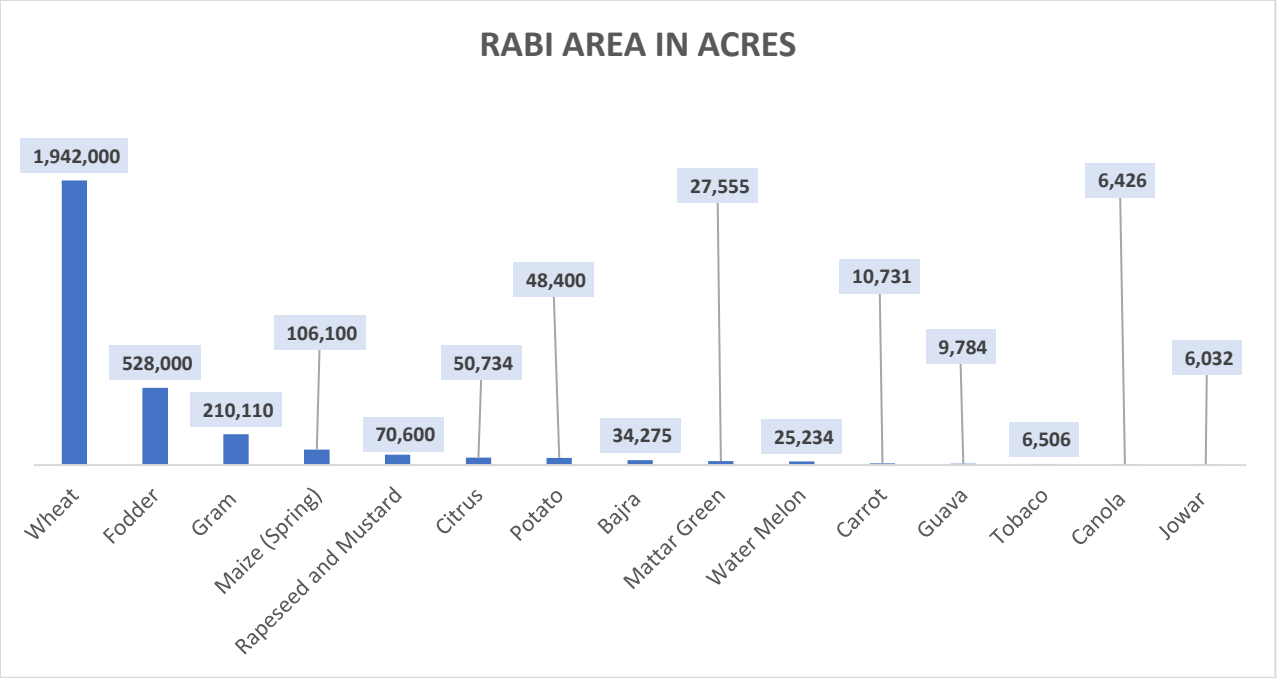


Figure 8: Current Cropping Pattern in Rabi
Source: Crop Reporting Service

Figure 9 below illustrates the current Kharif cropping pattern. This season, Fodder, Rice and Sugarcane make significant contributions to the area's output. The Faisalabad Division is only seeing an output of Rs.66,000 per acre in the Kharif season, even though resources such as land, water (both ground and surface), and labor are abundant in the region. This area has a total Kharif area of 2,428,088 acres, of which 1,996,450 acres remain uncultivated.

To shift the cropping pattern towards higher value crops, it is essential to identify the agroecological conditions, the appropriate crops for the region, and the development of the value chain. The region has great agricultural potential that, however, has not been fully tapped. Plugging the gap in the existing supply chain of agricultural products with a specialized support system will help bridge this deficiency. Diversifying agriculture and addressing the barriers to production enhancement and increased profitability are essential steps to achieving the desired goals. By considering the agroecological conditions, certain crops have been proposed to effectively reach these set targets.

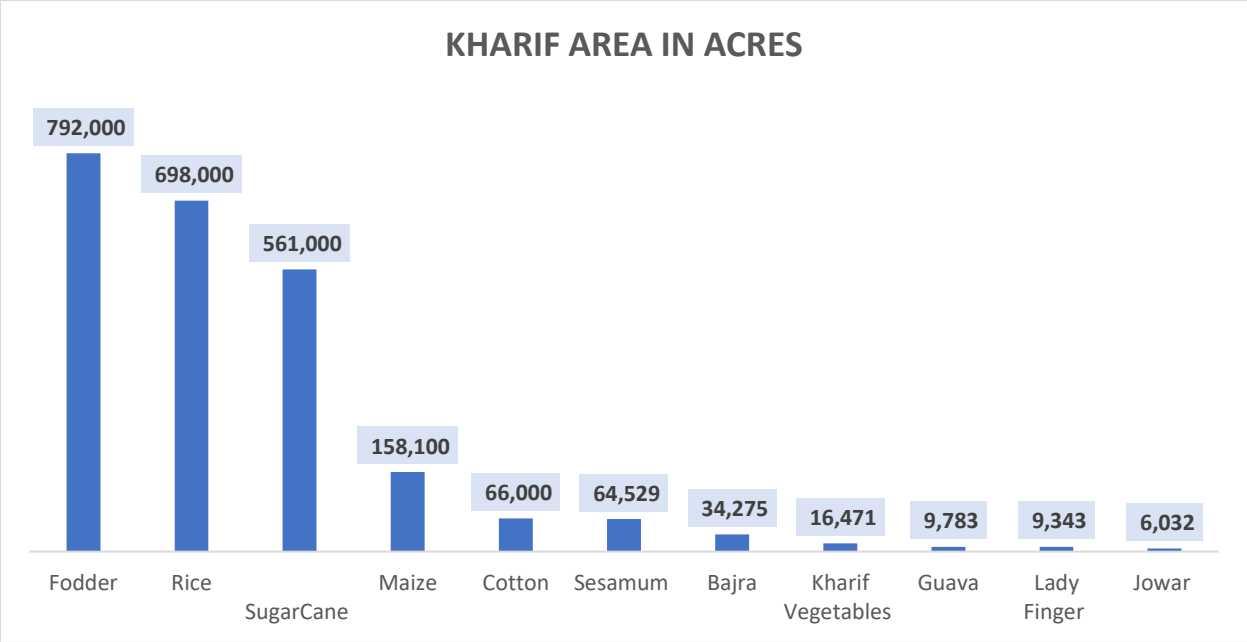
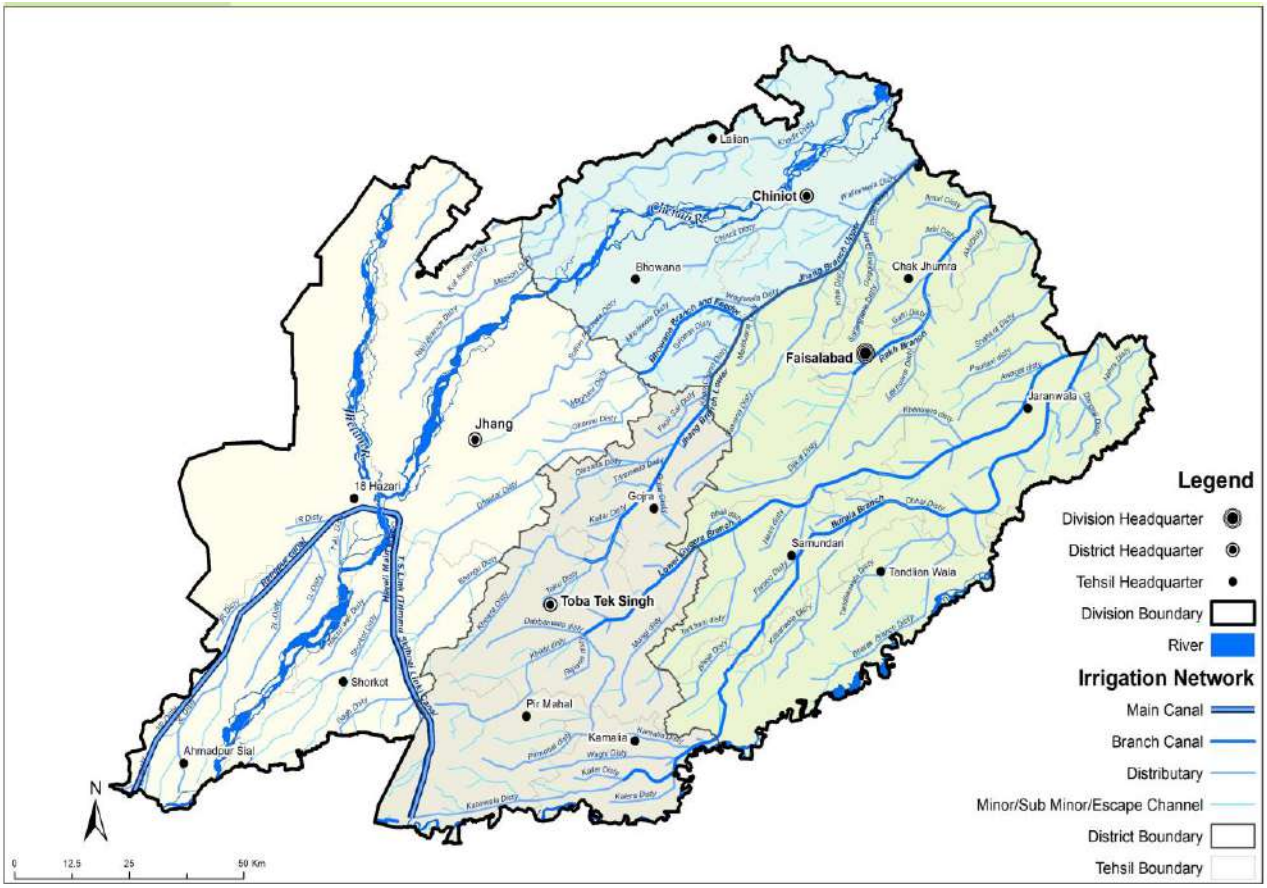


Figure 9: Current Cropping Pattern in Kharif
Source: Crop Reporting Service

1.6.3. INEFFICIENT WATER MANAGEMENT & POOR GROUNDWATER SUITABILITY

The Faisalabad Irrigation Zone is made up of Lower Chenab Canal (LCC) distributaries including the Jhang Branch, Rakh Branch, and the Gugera Branch Canal. The surface water availability is 2.1 feet/acre, which is extremely low compared to the Punjab average of 2.24. In addition, the efficiency of the system is very poor due to conveyance and field application losses which have resulted in a low total water availability. This explains why there is a need for innovative interventions to maximize water efficiency and promote crops with high yields and low water usage. It is also important to spatially conserve water to ensure that areas with the greatest need receive sufficient irrigation. To meet international standards, Faisalabad Irrigation Network should prioritize water efficiency in the Faisalabad division.



Map 1: Irrigation Network
Source: Punjab Irrigation Department

1.6.4. POOR FARM MECHANIZATION

The poor farm mechanization constraints faced in the Faisalabad region are due to the following main reasons:

1. Lack of Access to Financing: Many farmers in Faisalabad lack access to financing needed to purchase mechanized farm equipment. This is due to a lack of knowledge about available financing options and the high cost of farm machinery.

2. High Cost of Mechanization: The cost of mechanization is very high and many farmers cannot afford it. This is due to the high cost of machinery, the lack of access to credit, and the lack of government subsidies.

3. Poor Infrastructure: Poor infrastructure in Faisalabad, such as inadequate roads and electricity, makes it difficult for farmers to access mechanized farm equipment.

4. Lack of Technical Knowledge: Many farmers lack the technical knowledge and skills required to operate and maintain mechanized farm equipment.

5. Poor Quality of Mechanization: The quality of mechanization in Faisalabad is often poor, leading to inefficient and unreliable operation of farm equipment.

6. Poor Maintenance: Poor maintenance of mechanized farm equipment often leads to its premature breakdown, resulting in increased costs and wastage of resources.

7. Low Productivity: Low productivity of farm equipment is one of the major challenges facing farmers in Faisalabad region.

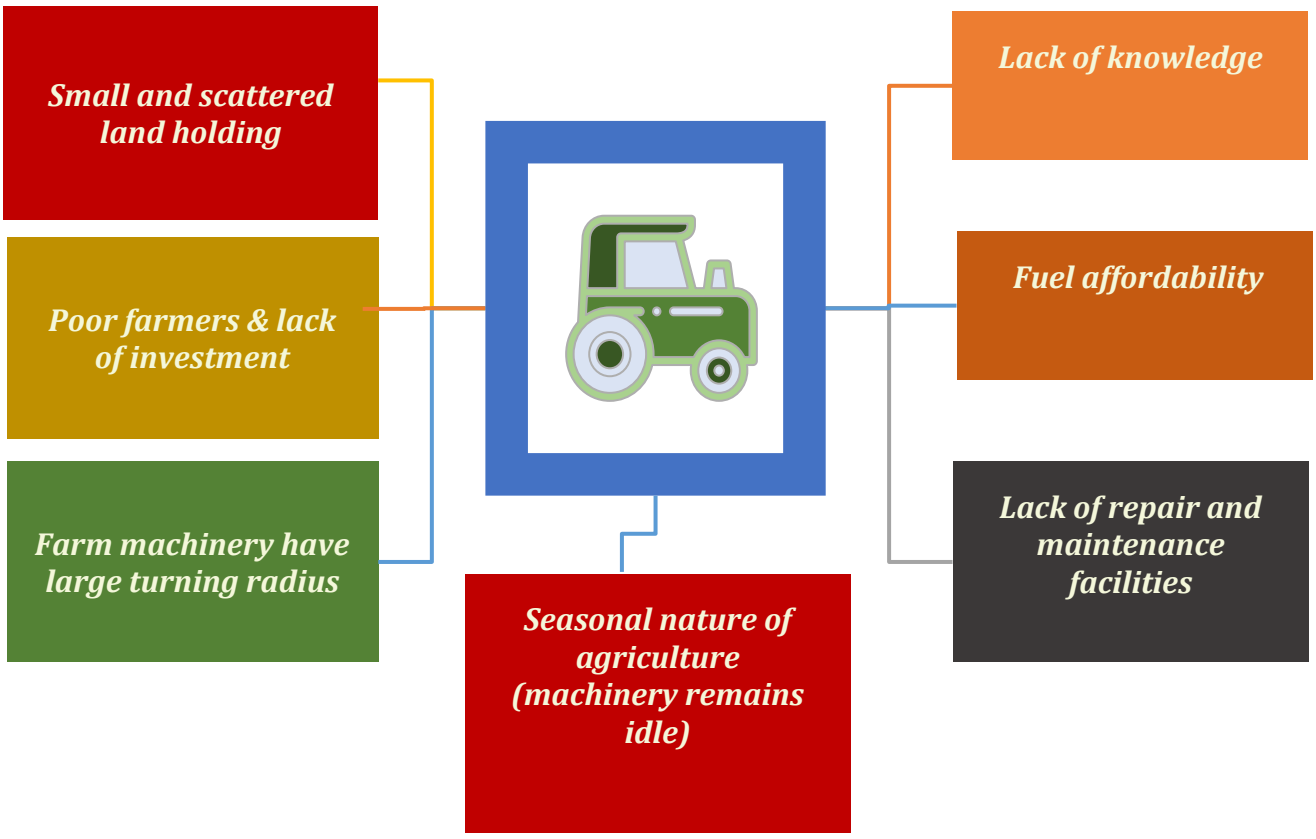
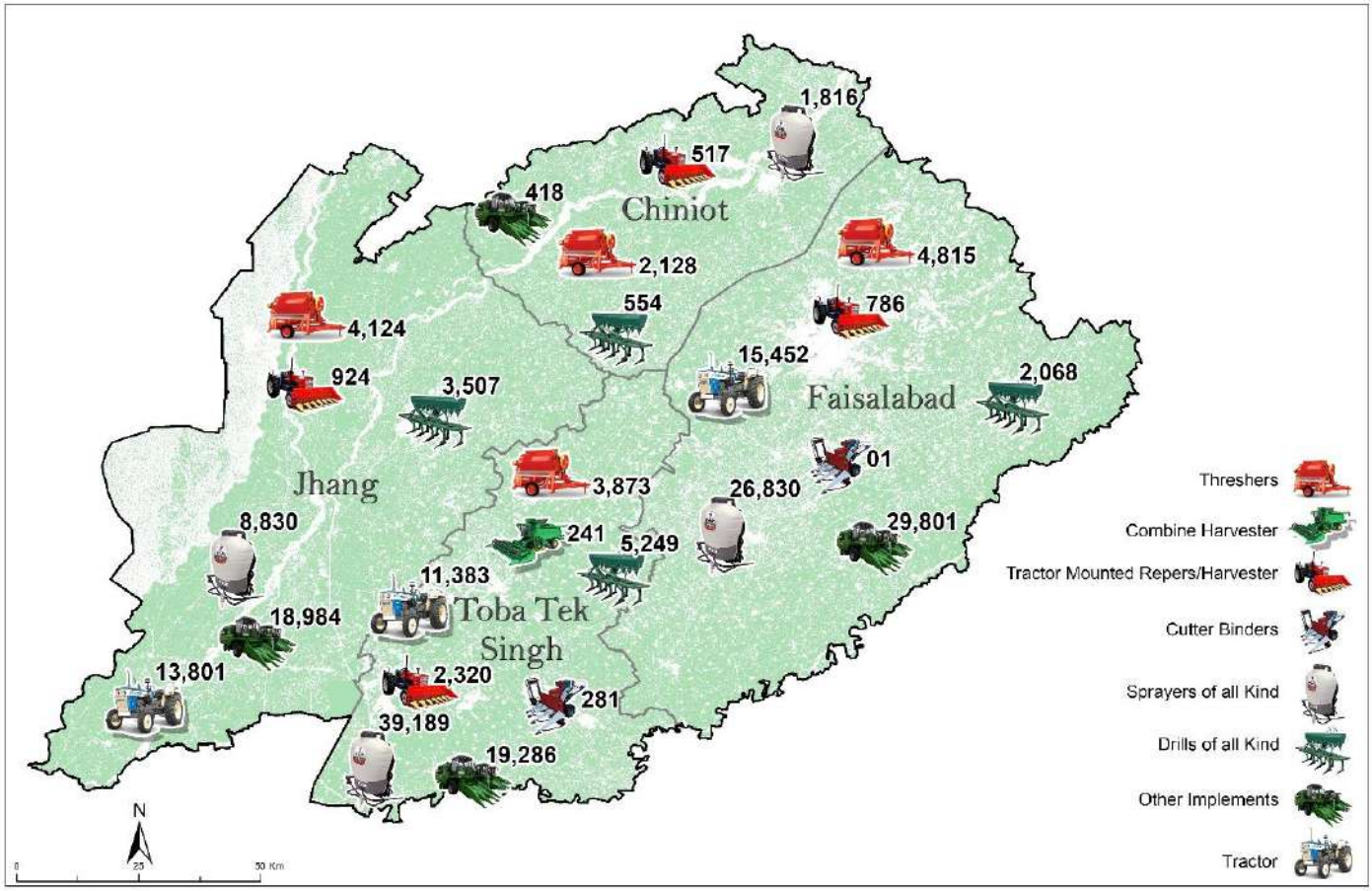


Figure 10: Snapshot of Poor Farm Mechanization in The Faisalabad Region
Source: Own Calculation

MAPPING OF AVAILABLE MECHANIZATION IN THE FAISALABAD DIVISON



Map 2: ***Poor Farm Mechanization***
Source: Punjab Development Statistics (2019)

1.6.4.1. MECHANIZATION GAP IN PUNJAB

Table 1 describes in detail the mechanization gap in Punjab in comparison to Indian Punjab. According to the existing implements coverage, the chisel plough, rotavator, and disc harrow have a very low share in Punjab when compared to Indian Punjab. To close the mechanization gap in Punjab, smart tools and service centers must be deployed in each crop zone to promote mechanization. This also implies that extension services are inadequate and that many farmers are unaware of modern methods such as agrochemicals, crop varieties, and fertilizer use.

Table 1: Mechanization Gap in Punjab

Implement	Applicability	Punjab (Per 10,000 acres)	Indian Punjab (Per 10,000 acres)	Existing Coverage As % of Indian Punjab
Tractors	All Crops	***140***	***295***	***47%***
Chisel Plow	Cotton Sugarcane	***2***	***28***	***8%***
Cultivator	All Crops	***102***	***224***	***46%***
Disc Harrow	All Crops	***5***	***118***	***4%***
Rotavator	All Crops	***14***	***155***	***9%***
Seed Drill	Wheat	***21***	***124***	***17%***
Ridgercum Fertilizer	Sugarcane Cotton	***22***	***56***	***38%***

Source: Punjab Development Statistics (2019)

1.6.4.2. AVAILABILITY OF MACHINERY

The availability of agricultural machinery is depicted in Table 2. It can be seen that thirty-five farmers are provided with a single piece of machinery, a thresher, which covers 261 acres of land. This represents the amount of machinery received by the specified number of farmers in the Faisalabad division. Furthermore, the overall effects of mechanization had always been positive. Farm mechanization not only increases farm income and labour productivity, but it also creates off-farm employment in manufacturing, agricultural machinery supply/maintenance, and agricultural produce post-harvest operations.

Table 2: Availability of Machinery

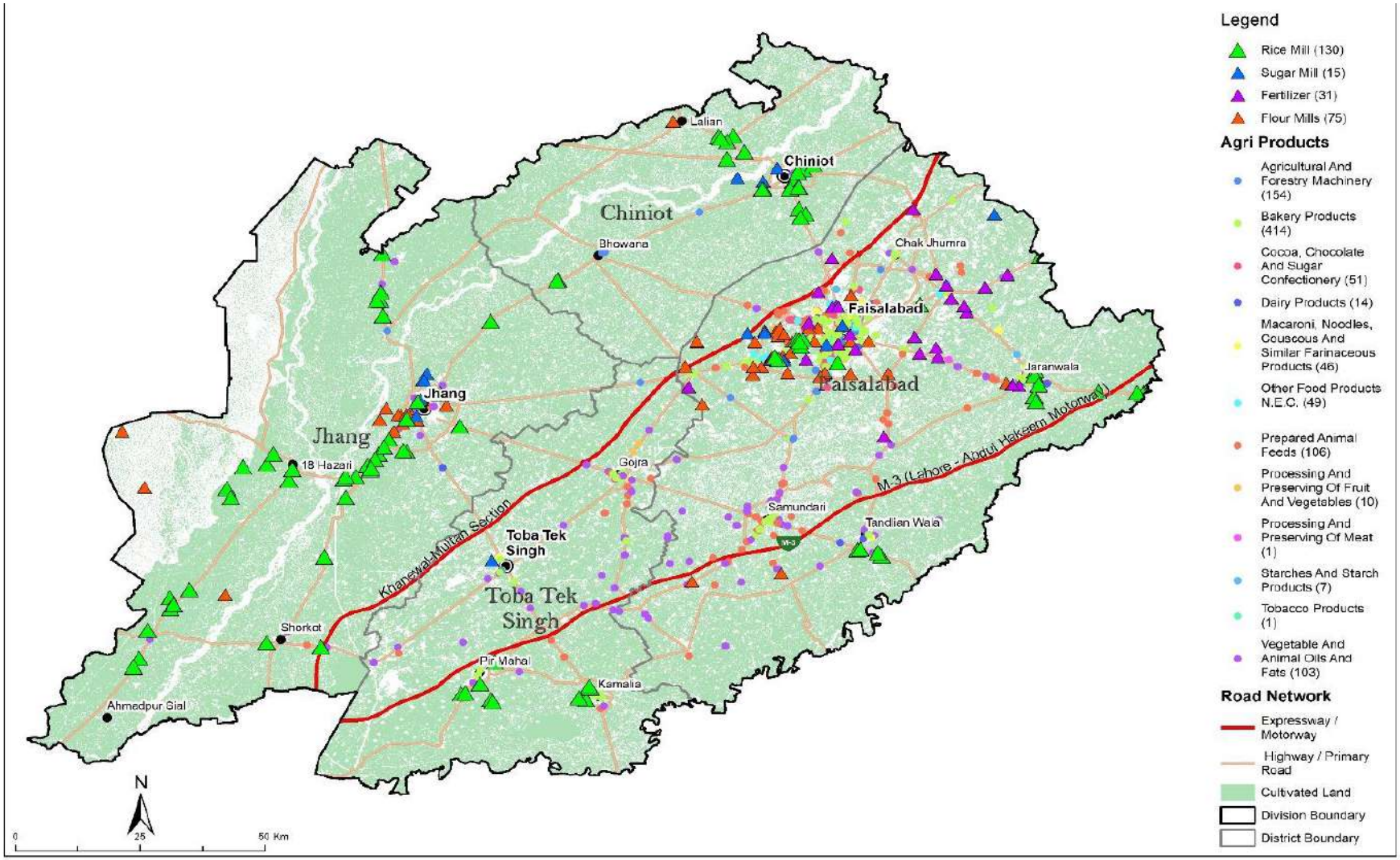
Agriculture Machinery	(Farmers/Machine)	Acres / Machine
Threshers	***35***	***261***
Self-Propelled Combine Harvester	***3,018***	***22,690***
Tractor Mounted Reapers/Harvester	***116***	***869***
Cutter Binders	***3,633***	***27,312***
Sprayers of all Kind	***14***	***102***
Drills of all Kind	***52***	***394***
Other Implements	***11***	***81***
Tractor	***19***	***145***

Source: Punjab Development Statistics (2019)

1.6.5. LOW-VALUE ADDITION & EXISTENCE OF TRADITIONAL AGRO-BASED INDUSTRY

Traditional agro-based industries in the Faisalabad division include the production of cotton, maize, wheat, oil seeds, sugarcane, fruits, vegetables, and other agricultural produce. These industries are small-scale and have low value-addition. These industries employ local people, use natural resources, and generate income for the local population. For example, Faisalabad is known for its production of cotton and other natural fibers, while Jhang is famous for its production of maize, wheat, and oil seeds.

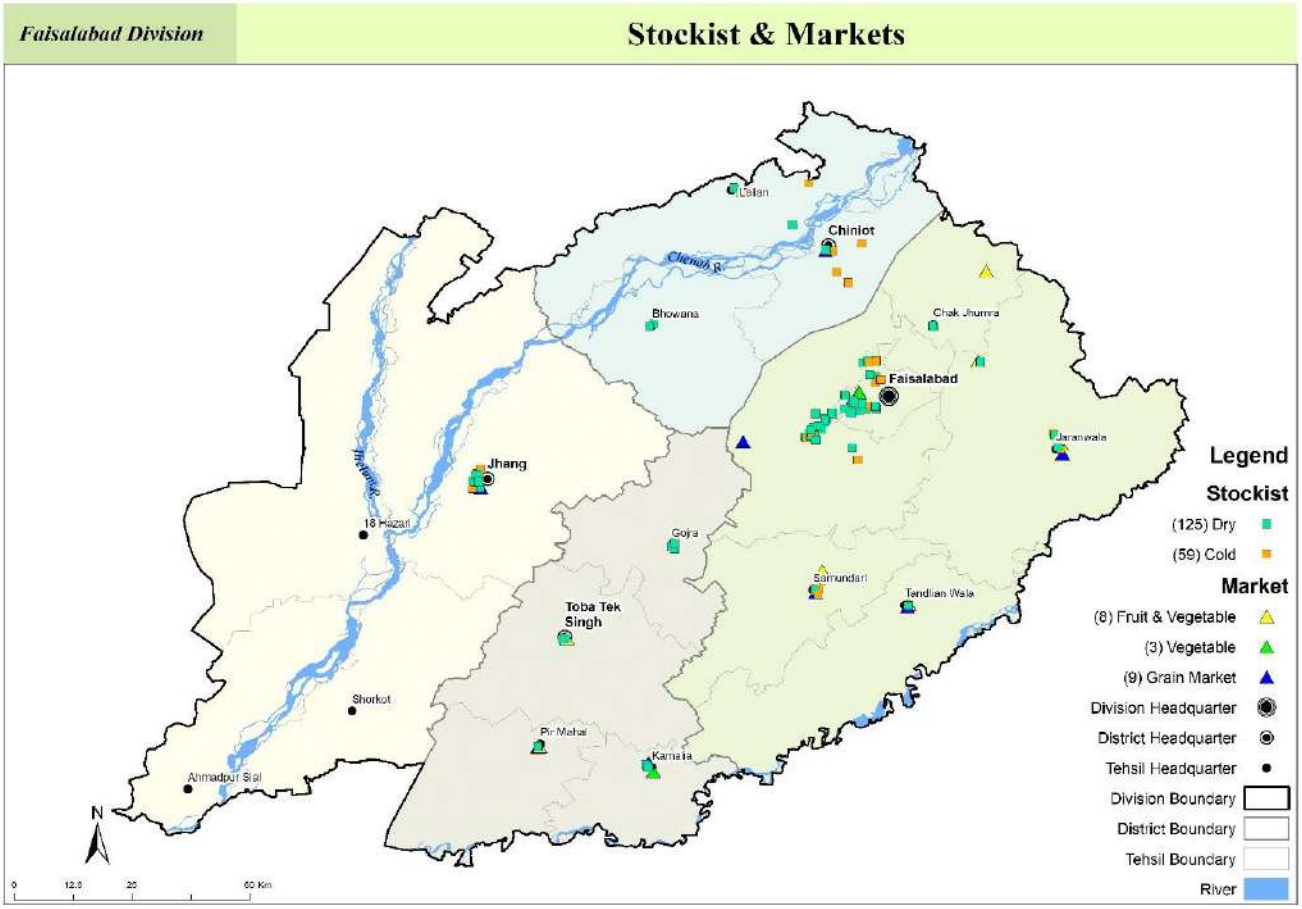
Map 3 shows the spatial distribution of rice, sugar, fertilizer, and flour mills in the Faisalabad region. Low-value addition in agriculture produce especially in High-Value Crops is seen in this region. Also, the industrial units are not located in the potential crop zones. Moreover, there is no processing industry for HVC. The availability of district-wise agro-based industries in the region is shown in the map below.



Map 3: Agro-Industry in Faisalabad Division
Source: Urban Unit

1.6.6. PREVIEW OF AGRICULTURAL MARKETS

Map 4 shows the inefficient markets in the Faisalabad region. The majority of the markets are located in isolation and are not within reach of the farmers. Also, a huge number of fruits and vegetable markets are not functional in various tehsils of the Faisalabad division. Due to this the role of the Middle man has reduced the profit margin of the farmer, as shown in table 8.



Map 4: Markets in Faisalabad Division
Source: Urban Unit

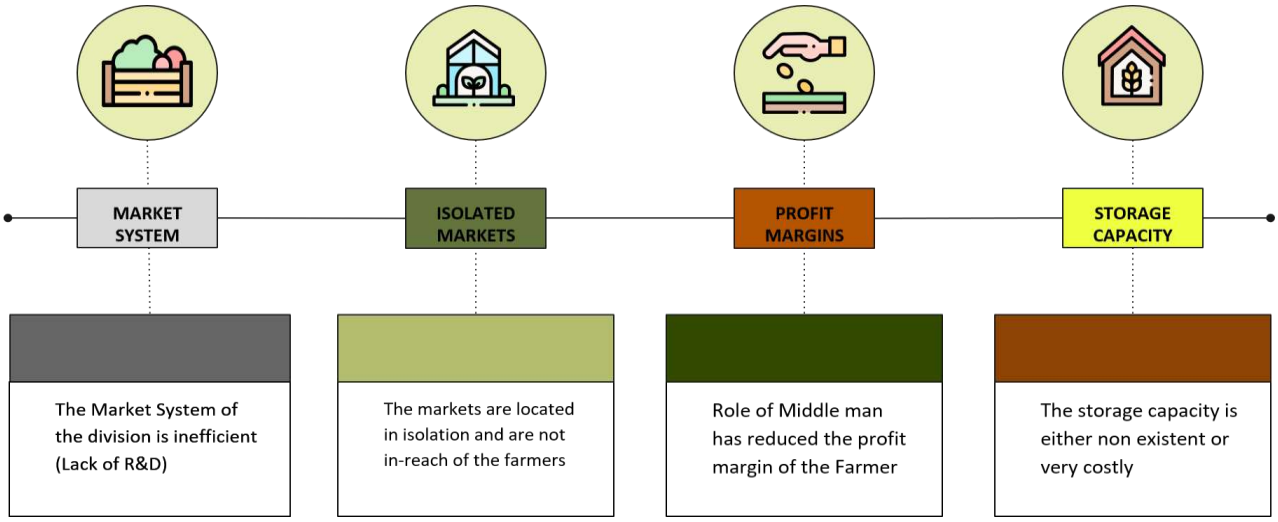
1.6.6.1. REASONS FOR INEFFICIENT AGRICULTURAL MARKETS

Table 3 shows that there is no proper storage capacity in markets and the existing storage capacity is costly. The commodity/crops prices are shown below as an example to show the inefficient market behavior in the Faisalabad region. The markets are located in isolation and are not in-reach of the farmers. The Role of Middle man has reduced the profit margin of the Farmer, such as shown in the following table:

Table 3: Agriculture Markets

Commodity	Farm gate price (PKR/kg)	Wholesale Market (PKR/kg)	Retail Price (PKR/kg)
Tomato	15-20	60-75	100-150
Lady Finger	20-25	70-90	130-150

Mostly inefficiency exists in the perishable commodities since there is no proper storage capacity in markets and the existing storage capacity is very costly. Some common reasons are listed below:



1.6.7. CURRENT IMPACT OF CLIMATE CHANGE

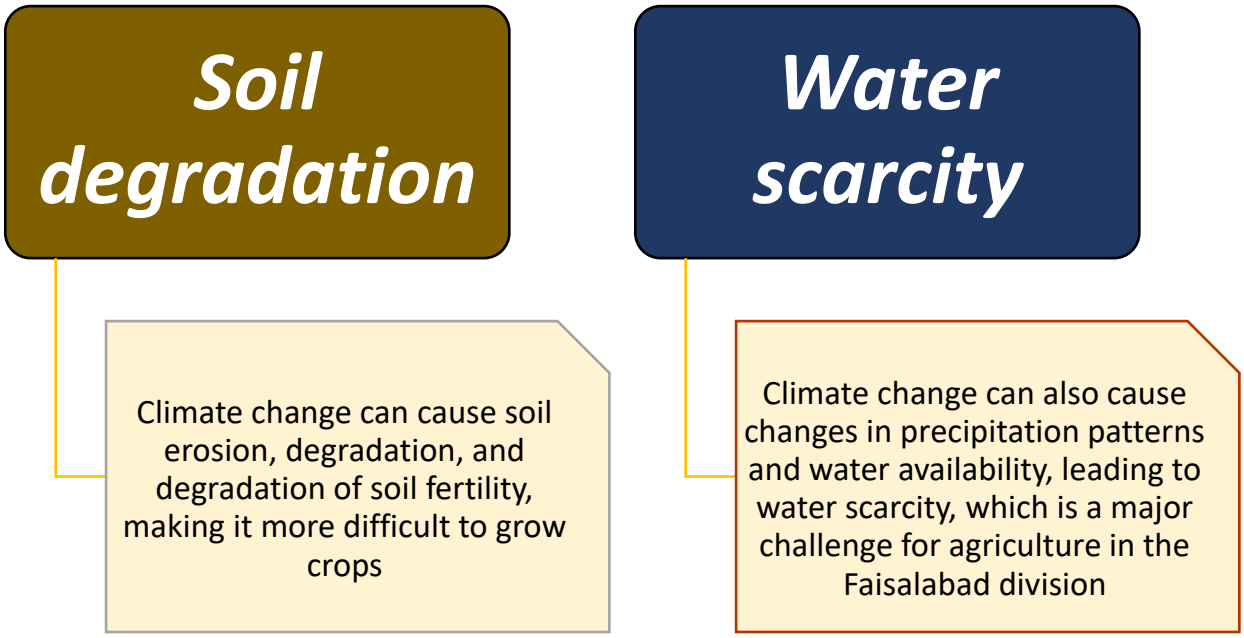
Climate change is having a significant impact on the agriculture sector in the Faisalabad division and in many other regions around the country. Some of the impacts of climate change on agriculture in the Faisalabad division may include:

Changes in temperature and precipitation patterns

Climate change can alter growing seasons, causing crops to be more susceptible to drought or flooding. This can lead to decreased crop yields and productivity

Increased pest and disease pressure

Climate change can also create ideal conditions for the spread of pests and diseases, which can further reduce crop yields and quality



1.6.7.1. THE AGRICULTURAL VULNERABILITY TO CLIMATE CHANGE

(Nadeem et al., 2022) examines the agricultural vulnerability to climate change across districts in Punjab province and identifies the significance of adaptive capacity in mediating district-level vulnerabilities. The findings highlight the need for policies that prioritize building adaptive capacity in vulnerable regions of Punjab and suggest that a one-size-fits-all adaptation policy that does not account for local variations in the causes of vulnerability is unlikely to be effective. The study employs a livelihoods approach and statistical associations to identify factors that shape adaptive capacity, such as human, financial, and social capital, and underscores the importance of effective government policies in supporting such factors. To inform top-down policy initiatives, there is a need to integrate climate change policies with general economic and social development policies in Punjab, with a focus on socio-economic aspects that account for place-based biophysical features and local-scale information.

The assessment of the vulnerability of agriculture in the Faisalabad division has been given below.

The assessment of the vulnerability of agriculture includes the following variables in the respective dimension in the Faisalabad division.

Exposure Index

- Annual temperature
- Annual Rainfall
- Floods

Sensitivity Index

- Population in administrative jurisdiction
- Farm size
- Crop diversification
- Agroforestry potential
- Irrigated land
- Cultivated land

Adaptive Capacity

- Natural capital: Groundwater availability, Land productivity
- Physical capital: Access to the power supply, Agricultural machinery ownership, Access to transport networks
- Human capital: Literacy level, Health attainment
- Financial capital: Livelihhods diversification, Access to credit, Livestock ownership
- Social capital: Access to cooperative societies, Means of social support, Local committees access

Table 4: Assessing the Vulnerability of Agriculture in Faisalabad Division

Indicators	Faisalabad	Jhang	Chiniot	Toba Tek Singh
Exposure Index	(0.00 - 0.19) Very Low Exposure	(0.00 - 0.19) Very Low Exposure	(0.00 - 0.19) Very Low Exposure	(0.00 - 0.19) Very Low Exposure
Sensitivity Index	(0.40 - 0.59) Moderate Sensitivity	(0.40 - 0.59) Moderate Sensitivity	(0.20 - 0.39) Low Sensitivity	(0.20 - 0.39) Low Sensitivity
Adaptive Capacity Index	(0.80 - 1.00) Very high adaptive capacity	(0.40 - 0.59) Moderate adaptive capacity	(0.00 - 0.19) Very low adaptive capacity	(0.20 - 0.39) Low adaptive capacity
Vulnerability index	(0.00 - 0.19) Very low vulnerability	(0.20 - 0.39) Low vulnerability	(0.40 - 0.59) Moderate vulnerability	(0.20 - 0.39) Low vulnerability

Source: (Nadeem et al., 2022)

1.6.7.2.Building Climate Resilience in Agriculture: Sustainable Practices and Technology Adoption in Faisalabad Division

To mitigate the impacts of climate change in the Faisalabad division, it will be important to adopt sustainable agricultural practices and promote the use of technologies that can help farmers to adapt to changing conditions. This may include implementing water-saving irrigation systems, using drought-tolerant crop varieties, and investing in soil conservation and management practices.

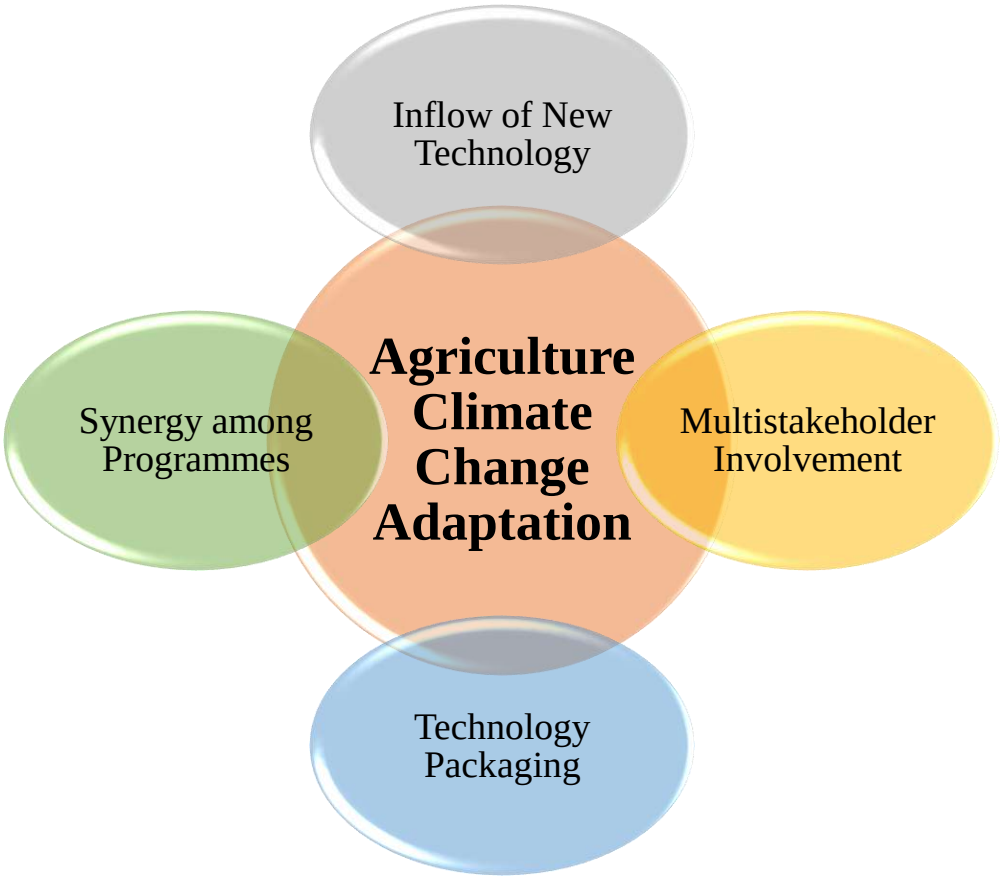


Figure 11: Key strategies essential for climate change adaptation in agriculture sector
Source: (Rao et al., 2019)

A systematic review paper on climate change adaptation in the agricultural sector in Pakistan identified four major themes of adaptation strategies: changing cropping practices, changing farm management techniques, advanced land use management measures, and non-agriculture livelihood options (Saddique et al., 2022). These themes were further broken down into 16 subthemes. The review found that factors influencing farmers' adaptation strategies in Pakistan include age,

education, farming experience, landholding, access to climate information, access to credit facilities, and access to extension services. Several constraints were identified at the farm level that hindered the adaptive capacity of farm households, including a lack of access to information and knowledge, extension services, credit, and farm resources.

The objective of the Pakistan Punjab Irrigated Agriculture Productivity Improvement Program Project is to enhance the productivity of water use in irrigated agriculture, leading to increased agricultural production, employment, and incomes, as well as improved living standards and positive environmental outcomes. By 2019, the project had installed high-efficiency irrigation systems covering 23,500 hectares, with a further 3,677 hectares in progress. It had also improved 11,916 watercourses with 1,220 more in progress, deployed 5,000 laser land-leveling units, and constructed 621 ponds. The project has directly benefited 500,000 farm families and improved water management on 5.7 million acres of farmland, creating more than 15,000 full-time jobs (Li & Ahmed, 2022).

PxD is working to identify high-impact opportunities for climate change mitigation that leverage local knowledge in low- and middle-income countries, as well as their expertise in combining product development, behavioral science, and human-centered design with robust experimentation. They aim to explore climate financing mechanisms and MRV protocols that bridge the environmental efforts of smallholder farmers and global climate finance, with a focus on benefiting farmers working in the service of mitigation. They aim to partner with nonprofits and research institutions to develop robust mitigation programs and add new agrarian ladders out of poverty to those that have come in decades and centuries past (PAD-admin, 2022).

Overall, climate change is a complex and pressing issue that will require collective action and cooperation from multiple stakeholders to address effectively. It will be important to continue to monitor and understand the impacts of climate change on agriculture in the Faisalabad division and to take proactive steps to mitigate these impacts and promote the sustainability of the agricultural sector in the region.

1.6.8. CLIMATE SMART AGRICULTURE

Climate-smart agriculture (CSA) is an approach to farming that seeks to address the interrelated challenges of food security, climate change, and sustainable agriculture. CSA aims to increase agricultural productivity and income, while also improving resilience to climate change and reducing greenhouse gas emissions.

Sustainability increases	Strengthen resilience	Reduces Agriculture's Contribution to Climate Change

This approach involves the use of sustainable land management practices, such as agroforestry, conservation agriculture, and improved livestock management, to improve soil health, water conservation, and carbon sequestration. Additionally, CSA promotes the use of climate-resilient crop varieties and the adoption of technologies that help farmers adapt to changing weather patterns. CSA also considers the social and economic aspects of agriculture, such as gender equity, rural development, and access to markets and finance. It is an integrated approach that combines technical solutions with social and institutional support, and involves collaboration among farmers, researchers, policymakers, and other stakeholders. Overall, climate-smart agriculture offers a promising pathway to sustainable agriculture that addresses both the challenges and opportunities of climate change.

1.6.8.1. CLIMATE-SMART AGRICULTURE FRAMEWORK

Qualitative research is used to explore the digitalization process in the Faisalabad region. The research would focus on understanding the current stage of digitalization in the value chain, the barriers and challenges faced by stakeholders in the value chain, and the benefits of digitalizing the value chain. It would involve interviews and focus groups with stakeholders from across the value chain, including farmers, traders, processors, retailers, and end consumers. The research would also involve an analysis of the existing digital infrastructure and systems to identify potential opportunities for improvement. The findings of the research would be used to develop a roadmap for digitalizing the value chain in Faisalabad, with specific recommendations for stakeholders. This roadmap would also include strategies for overcoming barriers and challenges, and for encouraging adoption of digital technologies in the value chain.

Digitalization of the value chain in Faisalabad would bring numerous benefits to stakeholders. For example, digitalizing the value chain would allow for improved tracking and traceability of crops, improved inventory and logistics management, and reduced costs and improved efficiency. It would also create opportunities for greater collaboration and information sharing among stakeholders, which would facilitate better decision-making and improved decision-making processes. In addition, digitalizing the value chain would reduce food waste and improve food safety, by providing real-time data on the quality and origin of crops.

Finally, digitalizing the value chain would enable greater transparency and accountability, by providing access to data that can be used to identify weak links in the value chain and areas for improvement. The success of digitalizing the value chain in Faisalabad will depend on the willingness of stakeholders to adopt digital technologies. To encourage adoption, it is important to ensure that stakeholders understand the potential benefits of digitalization, and to provide them

with the necessary technical and financial support. Additionally, it is important to ensure that stakeholders have access to digital infrastructure, such as reliable internet access, and to provide training and support to enable them to use digital technologies effectively.

The Faisalabad region of Pakistan is one of the fastest growing economic hubs in the country, with its established agricultural sector, burgeoning manufacturing industry, and dynamic service sector. In recent years, the region has also seen a significant increase in the use of digital technologies. This has enabled the region to emerge as a leader in the digitalization of its value chain assessment process. The digitalization of value chain assessment has been identified as an important factor in the development of the region and its economy. The Urban Unit explores the qualitative approach taken by the Faisalabad region towards digitalization of value chain assessment. It looks at the key factors that have enabled the successful implementation of digitalization, the challenges faced by the region in doing so, and the potential pitfalls and opportunities that come with digitalization.

The Faisalabad region has needs to implement digitalization of value chain assessment as an important part of its economic development strategy. It will enable the region to build a strong value chain assessment system that is able to effectively identify areas of improvement, identify opportunities for growth, and guide strategic decision-making. The region must adopt a qualitative approach to digitalization of value chain assessment. This involves the use of digital technologies to gather data and information from a variety of sources, including local farmers, agricultural experts, and industry stakeholders. This data will then be analyzed and used to identify areas for improvement and opportunities for growth. The Faisalabad region must also take steps to ensure that digitalization of value chain assessment is a collaborative process. This includes engaging with farmers, industry stakeholders, and other experts to ensure that the data being gathered and the analysis being done is accurate and relevant.

Past assessments of the digitalization of the agriculture value chain in the Faisalabad region have shown that there is a lack of awareness and understanding among farmers about the benefits of technology-based solutions. This has been a major obstacle in the adoption of digital solutions in the agriculture sector in the region.

Additionally, a lack of infrastructure, including limited access to electricity and internet, has also been a hindrance in the implementation of digital solutions in the region.

Despite these challenges, there have been some successful implementation of digital solutions in the region, such as the use of drones for crop monitoring, precision agriculture techniques, and the use of mobile applications to connect farmers with buyers. These initiatives have demonstrated the potential of digitalization to improve the efficiency and profitability of the agriculture sector in the Faisalabad region.

In conclusion, while there have been challenges in the past, the digitalization of the agriculture value chain in the Faisalabad region holds great potential for the future. With increased awareness and investment in infrastructure, it is likely that the region will see greater adoption and benefits from digital solutions in the coming years.

The digitalization of value chain assessment in the Faisalabad region would enable the region to gain a better understanding of its local agricultural sector. This in turn will enable the region to make more effective decisions about resource allocation, identify areas of improvement, and plan for future growth. The implementation of digitalization will also allow the region to reduce its reliance on manual processes and paper-based records. This shall help in reducing the administrative burden and increases the efficiency of the region's value chain assessment process. In addition, it will allow

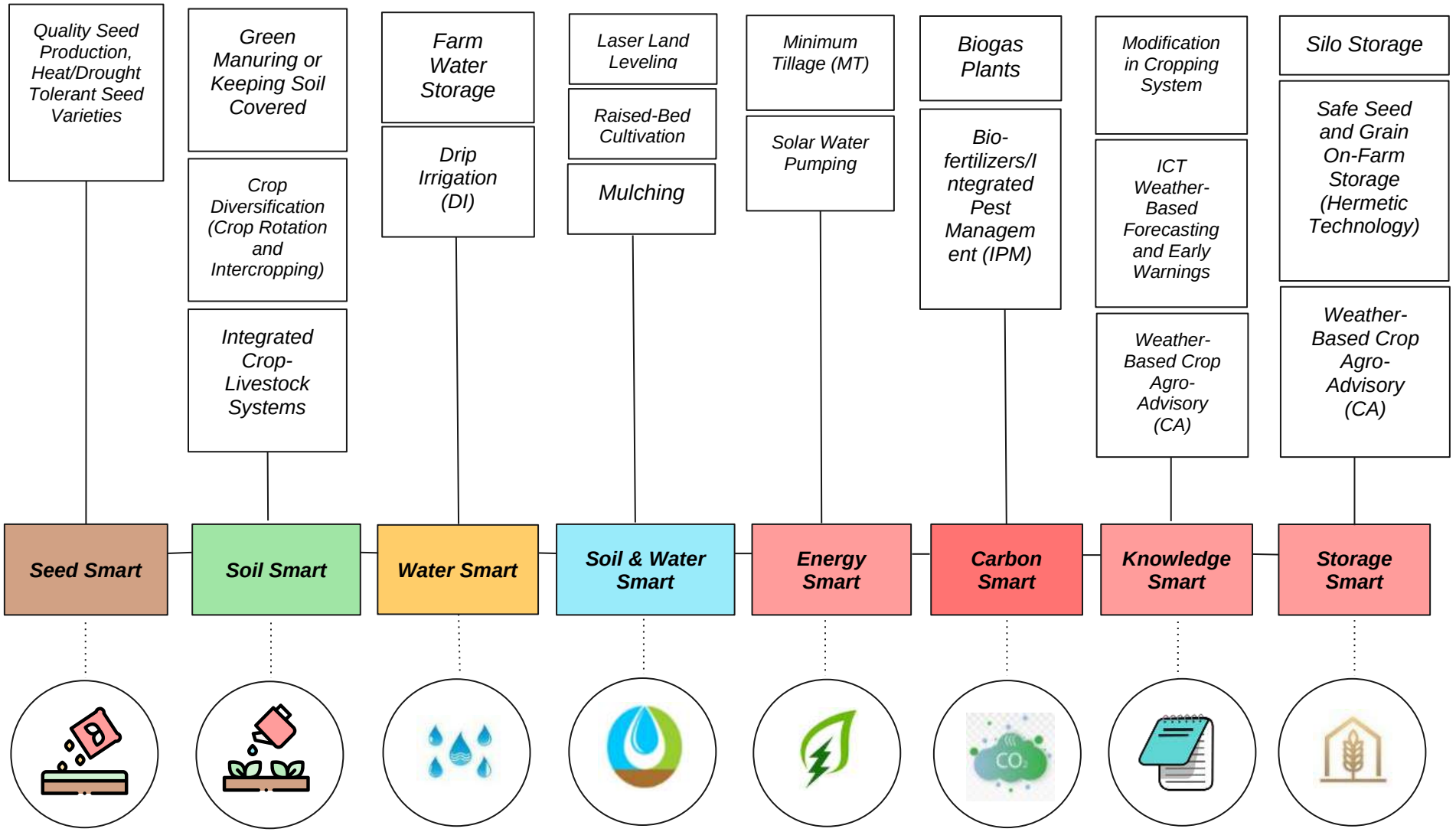
the region to take advantage of emerging technologies such as artificial intelligence and machine learning.

Pakistan faces significant challenges in implementing Climate Smart Agriculture (CSA) practices, which aim to promote sustainable and resilient agricultural practices. The challenges include water scarcity, extreme weather events, soil degradation, and low agricultural productivity. Pakistan is a water-stressed country, and climate change is exacerbating the situation, making water management a critical component of CSA. Extreme weather events such as floods, droughts, and heatwaves can have a significant impact on the agricultural sector and require CSA practices to help farmers adapt and mitigate the impacts. Soil degradation is also a major challenge, as sustainable agricultural practices must be developed to prevent further soil degradation and promote soil health. In addition, low agricultural productivity is a major barrier to implementing CSA practices, requiring access to technology, finance, and policies that support sustainable agriculture. Overcoming these challenges will be critical for Pakistan to implement CSA practices and build a more sustainable and resilient agricultural sector. Despite the benefits of digitalization of value chain assessment, the Faisalabad region might face a number of challenges in doing so. These include the lack of access to digital tools and resources, the lack of understanding of digital tools and techniques, and the lack of training for stakeholders in the region.

With an objective to train and disseminate climate-smart technology among the farmers, the project needs to establish model farms in different locations of the project districts. These model farms will serve as resource and demonstration centers providing technical assistance and technology transfer for groups. It will be the focal point for community coordination, networking, and linkages with service providers, input suppliers, and product marketing. The project staff would regularly visit these resource farms and strengthened them through input support, technical guidance, improved practices, and the introduction of low-cost technology.

1.6.8.1. IDENTIFIED TECHNOLOGIES AND PRACTICES FOR CSA

The diagram below highlights the identified technologies and practices for Climate-smart agricultural plan of Faisalabad division.



1.6.9. AGRO-ECOLOGICAL CONDITIONS

Climate is a prime factor that exerts a major influence on vegetation, soil health, and water resources. Changing climate is likely to elevate the vulnerability of agricultural systems (Rosenzweig et al., 2013) by increasing temperature, changes in rainfall patterns, and more frequent extreme weather events in the world (IPCC, 2014). There is an explicit change in the weather patterns in Pakistan (Ahmad et al., 2015). Subsequently, climate change and variability have impacted crop production and could also be the reason for the shift in cropping systems in some districts of the Faisalabad division.

Consequently, the urban unit has identified different Agro-ecological zones in the Faisalabad division based on Agro-climatic and Edaphic variables through which crop zoning has been identified;

- Identified suitability of crops in AEZs for sustainability.
- Assessment of Agro-economic performance in delineated agro-ecological zones.

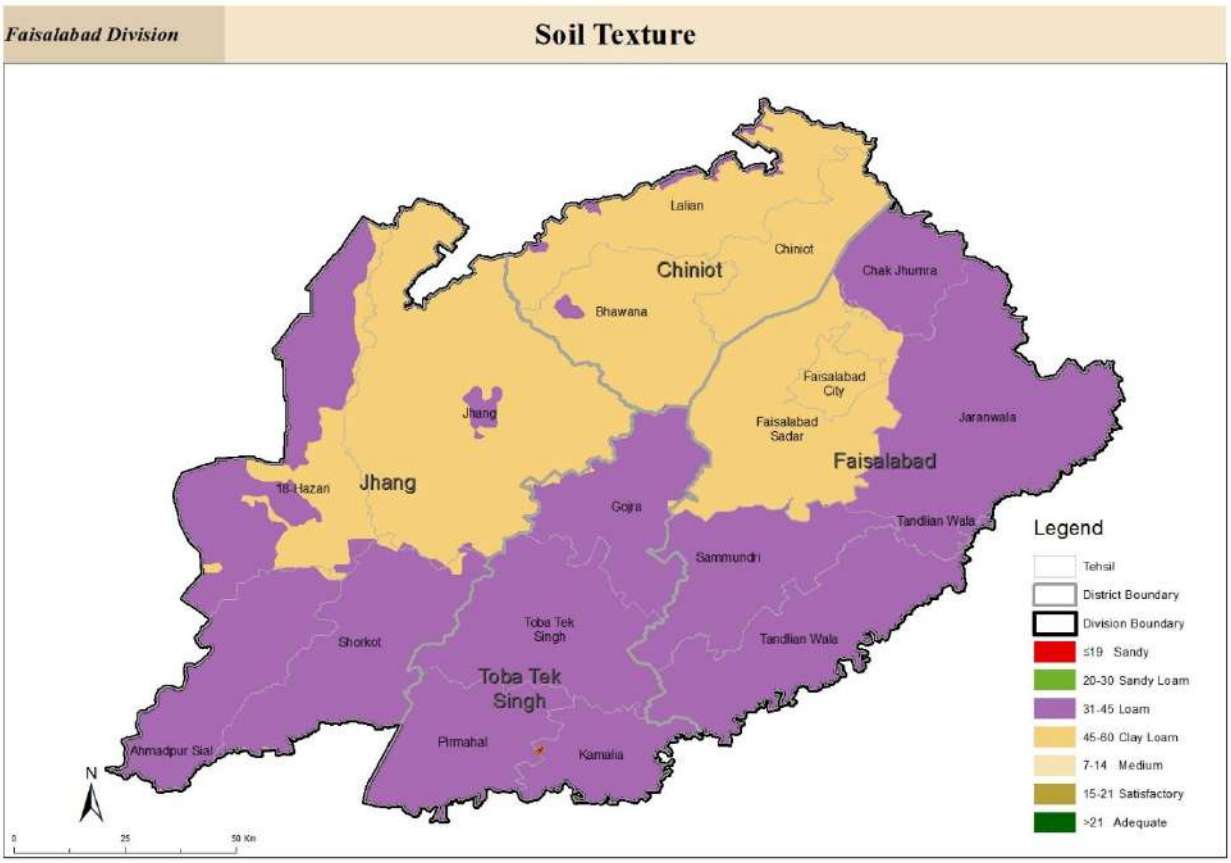
Faisalabad division, located in the Punjab province of Pakistan, is known for its fertile soil, which is primarily composed of clay, loam, and sand. The exact soil texture in the region can vary depending on the specific location, as well as the type of crop being grown.

Clay soils are characterized by high levels of nutrient retention and are good for crops that require a lot of moisture, such as rice. Loam soils are a mixture of sand, silt, and clay, and are considered ideal for growing a variety of crops due to their ability to hold moisture and nutrients. Sandy soils are well-drained and warm up quickly in the sun, which is beneficial for crops that require good drainage and warm temperatures, such as certain vegetables.

It's important to note that the specific soil characteristics of the Faisalabad division will also be influenced by factors such as soil pH, soil fertility, and soil structure, which can vary depending on the specific location within the region. A comprehensive soil analysis can provide information on the specific soil characteristics and fertility of a particular piece of land, which can be useful in determining the best crops to grow and the most effective methods of cultivation.

The soil is a key element of agriculture, without which we could not grow plants. Each type of soil is not suitable for each crop due to the effect of different crop growth factors. Soil conditions and characteristics are one of the key factors that directly drive crop growth potential and thus, a soil data set is key information when developing agro-ecological zones.

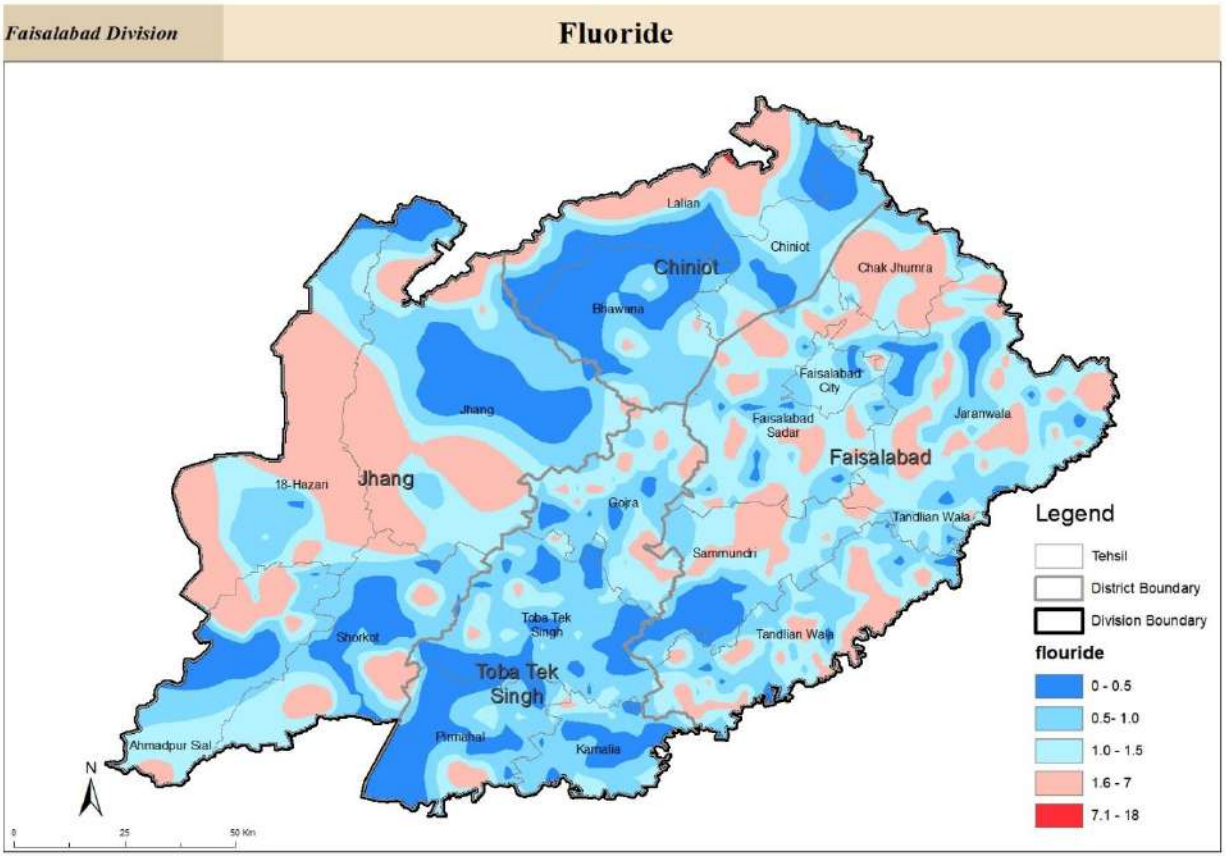
The texture is the most important parameter of soil. There are four different soil textures reflected in map 5 below i.e. Sandy Loam, clayey, Loam, and clay loam, which is the dominant soil in this region. Redefining AEZs was based on the moisture index calculated by using ET0 with an overlay of analysis of soil texture.



Map 5: Soil Texture of Faisalabad Division
Source: Urban Unit

Fluoride is a naturally occurring element that can be present in varying concentrations in groundwater, and high levels of fluoride in drinking water can have negative health effects. The concentration of fluoride in groundwater in the Faisalabad division of Pakistan can vary depending on the specific location and geological conditions.

Under the arid climatic conditions of large parts of Pakistan, high fluoride concentrations in the groundwater are to be expected at least in some areas. Excessive fluoride concentrations are a problem in parts of Punjab, Sindh, and Baluchistan (Tariq, 1981). Fluoride appears not to be a national problem but is a regional problem of sufficient magnitude to merit consideration in water-testing and supply programs. In some areas, high levels of fluoride in groundwater can be a concern, particularly in communities that rely on groundwater as their primary source of drinking water. Ingesting high levels of fluoride over a long period of time can lead to a condition known as fluorosis, which can cause damage to teeth and bones. The fluoride in the Faisalabad division shows varying concentrations in all districts.



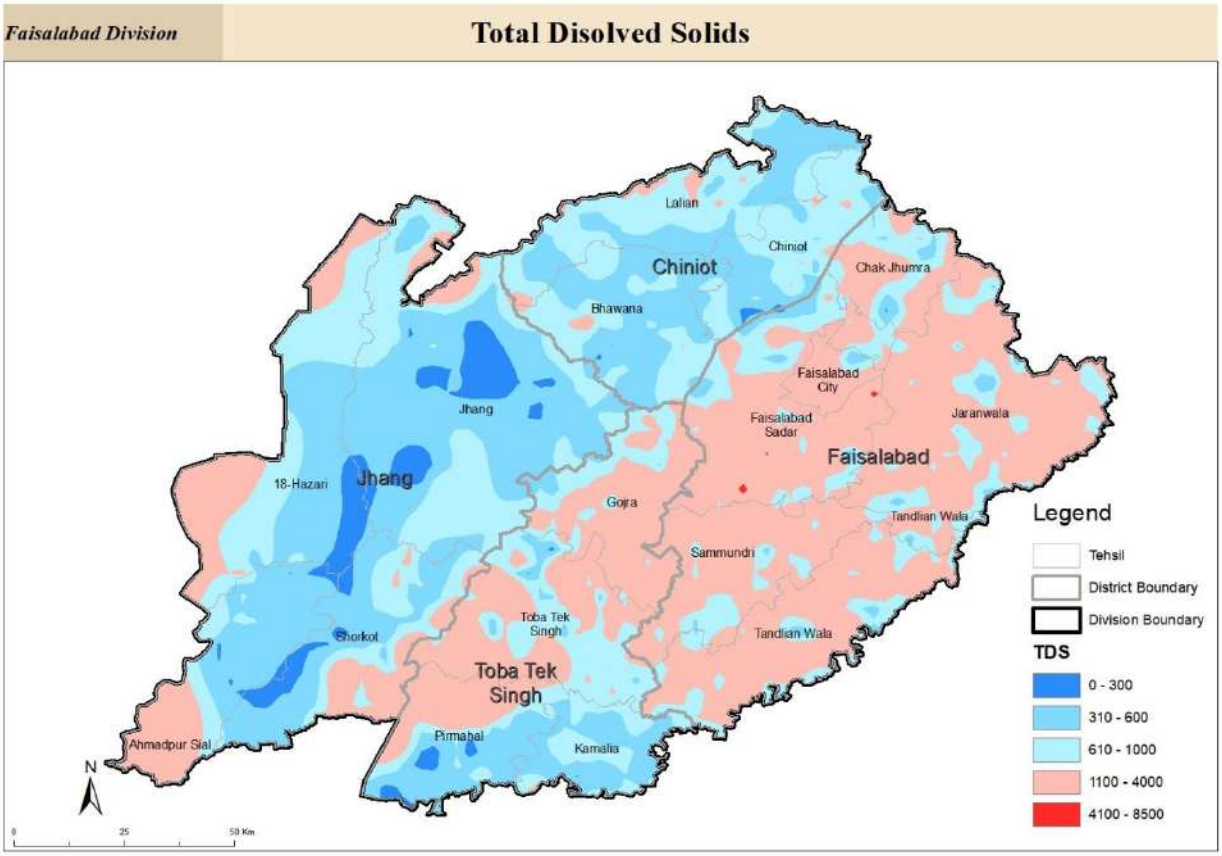
Map 6: Total Water Availability
Source: The Urban Unit

Groundwater in the Faisalabad division of Pakistan can contain varying levels of Total Dissolved Solids (TDS), which is a measure of the amount of inorganic and organic substances present in

water. High levels of TDS in groundwater can have negative effects on the quality and suitability of the water for various uses, such as drinking, irrigation, and industrial processes.

The TDS levels in groundwater in the Faisalabad division can be influenced by a variety of factors, including the geology of the area, land use practices, and anthropogenic activities. In some areas, high levels of TDS may indicate the presence of pollutants, such as salts, chemicals, and minerals, that can negatively impact the quality of the water.

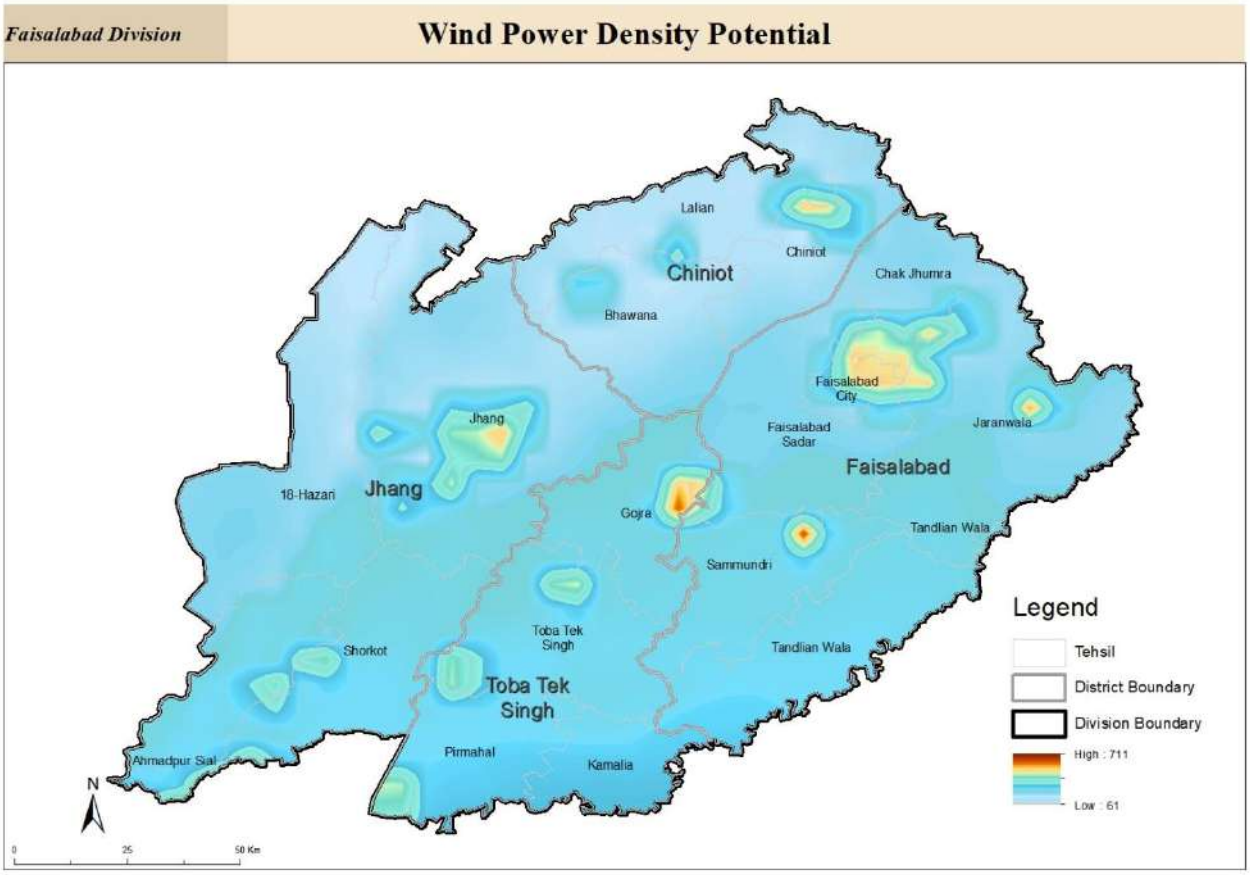
Groundwater not only supplies additional water to fulfill irrigation deficits but also provides flexibility to match crop water requirements. The groundwater of acceptable quality has the potential to provide the flexibility of water supply in canal commanded areas and to extend irrigation to rain-fed areas. It is estimated that up to 95% of all surface and groundwater is utilized for irrigation. Access to groundwater would assist farmers in dealing with the inconsistencies of surface supplies, diversifying cropping patterns, and converting uncertain crop yields into more sustained crop production. Since groundwater quality plays a crucial role in successful crop production, therefore groundwater quality map given below shows that most of the areas in the division are not suitable for crops in the Faisalabad and Toba Tek Singh regions.



Map 7: Groundwater (TDS)
Source: Urban Unit

The spatial distribution of weather station data points is used in the regional plan. The weather stations used for the collection of weather data include wind power, average yearly temperature, and solar irradiance.

Map 8 shows the wind power density potential (W/m2) observed for the Faisalabad region ranging from high 711 to low 61 density potential. A smaller portion of Faisalabad and Toba Tek Singh districts of the Faisalabad region falls under the high-density wind power areas.



Map 8: Wind Power
Source: The Urban Unit

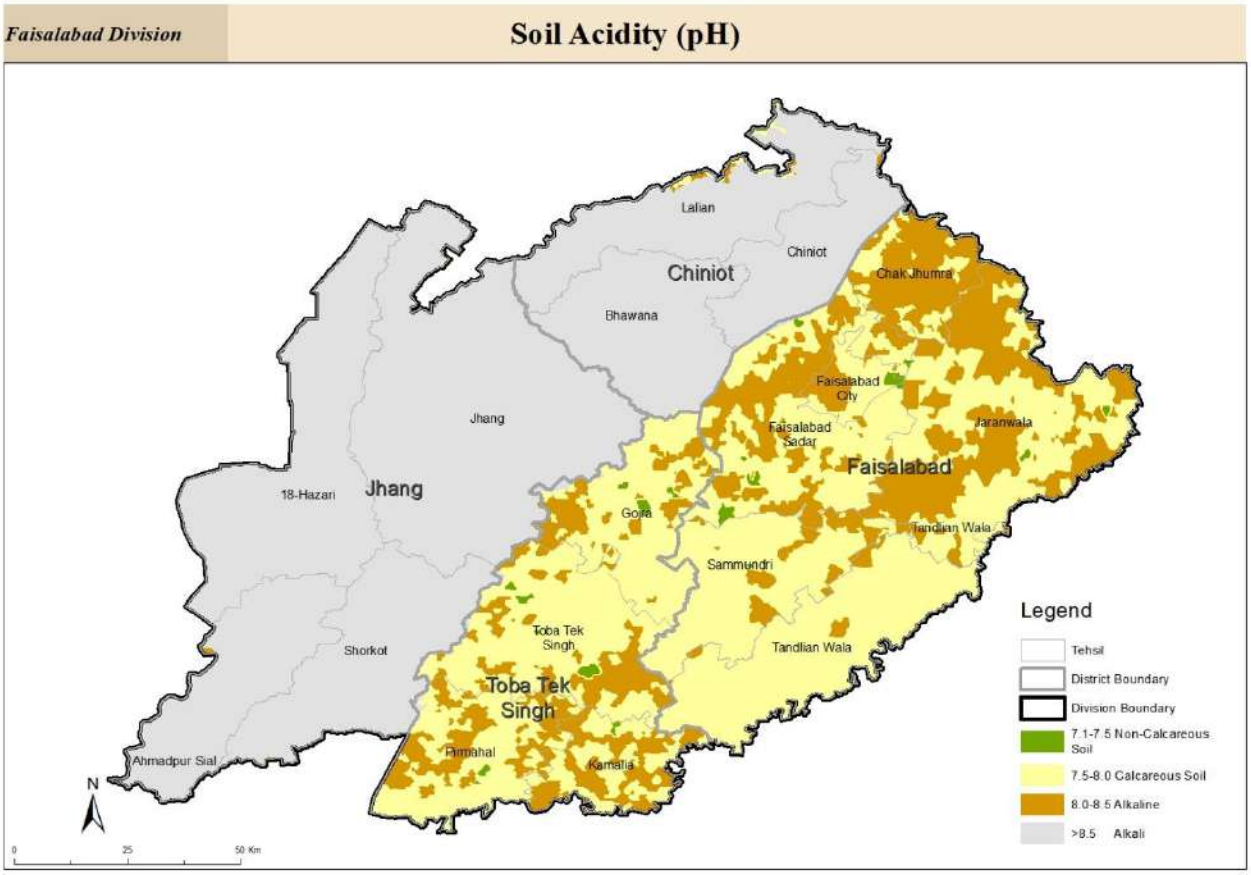
Soil pH is an important factor that can impact the growth and health of crops in the Faisalabad division of Pakistan. The pH of soil refers to its acidity or alkalinity, and it is expressed on a scale of 0 to 14, with 7 being neutral. Soil pH can influence the availability of essential nutrients for plant growth, as well as the presence of certain chemicals in the soil that can be harmful to crops.

In general, most crops grow best in soils with a pH between 6.0 and 7.5. However, the optimal pH range for a specific crop can vary depending on the type of crop and the specific growing conditions.

Soil pH can be influenced by a variety of factors, including the geology of the area, the type of soil, and land use practices, such as the application of fertilizers and liming materials. A comprehensive soil analysis can provide information on the specific soil pH of a particular piece

of land, which can be useful in determining the best crops to grow and the most effective methods of cultivation.

The Soil parameters like Soil pH have been observed in the Faisalabad region as shown below. The soil pH in the Faisalabad division ranged between 7.8-and 10.4 with an average of 8.42. In addition to it, Calcareous soil ranging from 7.5-8.5 pH has been observed in all districts of the Faisalabad division out of which Jhang and Chiniot are covered mostly with Alkali pH. The pH value of 5.5 to 6.0 (acidic) is considered to be an optimum for citrus cultivation; as the lower level tends to increase the leaching of lime and magnesium whereas the higher level is conducive to reducing the availability of trace elements. It is recommended that before planting the trees, it is desirable to determine the suitability of soil for crops and if necessary appropriate reclamation measures should be taken. It is also advised that the soil pH should be assessed once a year.



Map 9: Soil pH
Source: Urban Unit

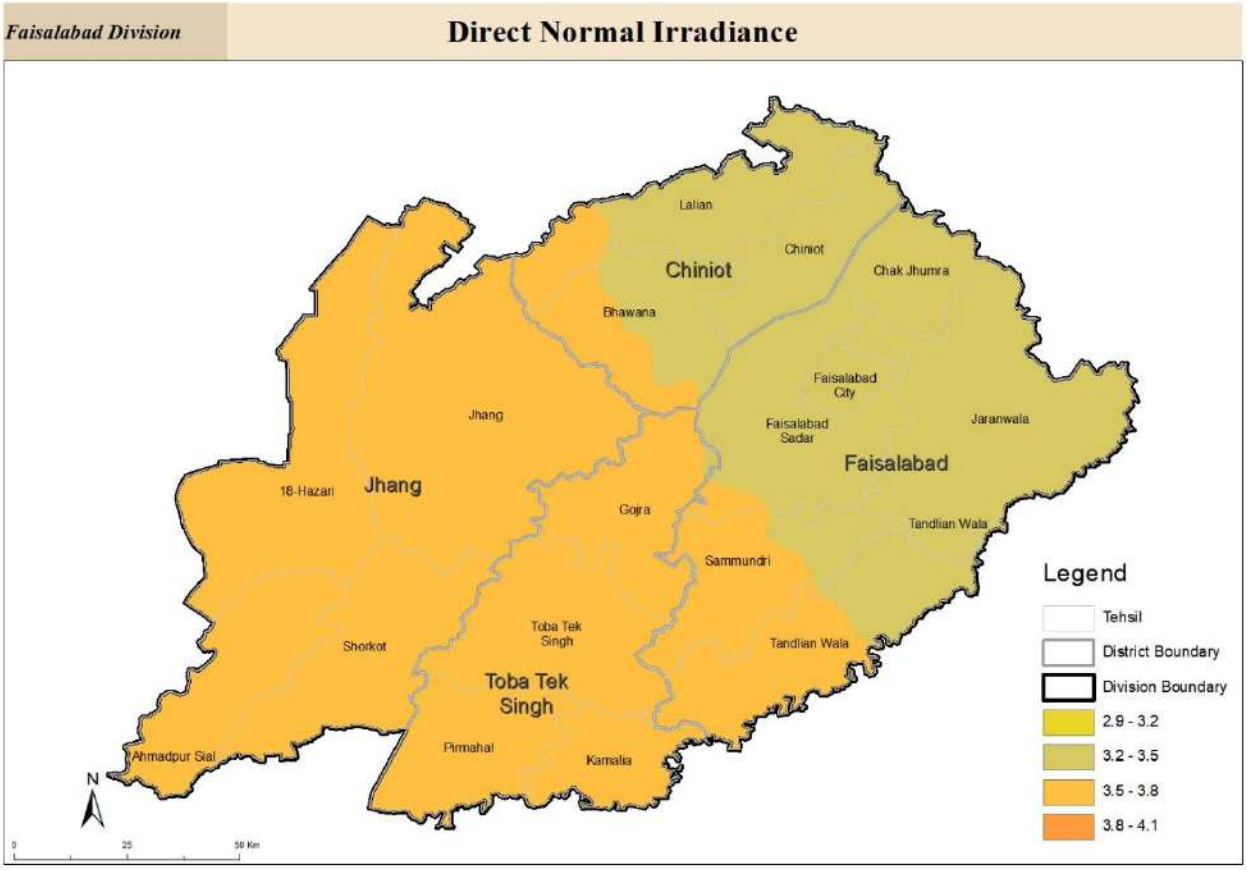
Direct solar normal irradiance refers to the amount of solar radiation that is received on a surface perpendicular to the sun's rays. This type of irradiance is important for many applications, including photovoltaic power generation, solar water heating, and the cultivation of crops. The strength received from the Sun in the form of electromagnetic waves as evaluated in the range of wavelength of the measurement device is referred to as solar irradiance.

The amount of direct solar normal irradiance received in the Faisalabad division of Pakistan can vary depending on several factors, including the time of year, the latitude of the area, and the weather conditions. In general, the Faisalabad division is located at a latitude of 31.41° N, which is near the tropic of Cancer, and is characterized by hot and dry summers and cool and wet winters.

The average daily direct solar normal irradiance in the Faisalabad division can range from 5 to 7 kilowatt hours per square meter per day (kWh/m2/day) during the winter months to as much as 9 to 12 kWh/m2/day during the summer months. However, actual irradiance levels will be influenced by local weather conditions, such as cloud cover, atmospheric stability, and air pollution, as well as the orientation and tilt of any surfaces receiving the radiation.

Accurate measurement of the direct solar normal irradiance in the Faisalabad division can be important for a variety of applications, including the design and optimization of solar energy systems, as well as the selection and cultivation of crops that are best suited to the local climate and growing conditions.

Direct Normal Irradiance (KWh/m2) is computed for the Faisalabad region with maximum solar irradiance observed in the Jhang and Toba Tek Singh districts.



Map 10: Solar Irradiance
Source: Urban Unit

Hence, based on the above agro-ecological conditions, the Faisalabad division is summarized on the following agro-climatic factors:

Table 5: Agro-Climatic Factors

Avg, rabi max temp (^{0}C)	Avg, rabi min temp (^{0}C)	Avg, Kharif max temp (^{0}C)	Avg, Kharif min temp (^{0}C)	Rainfall (mm)	ETo (mm)	Soil type	EC
28.09	12.31	39.28	27.31	230	3.20	Most Sandy	0.07-27
29.20	12.45	40.41	27.59	234	3.10	Loam, sandy loam (9%)	0.07-27
27.59	12.38	38.94	27.22	412	2.88	Loam, sandy loam (20%), clay loam (8%)	1-27

Source: Fao Agroecological Condition

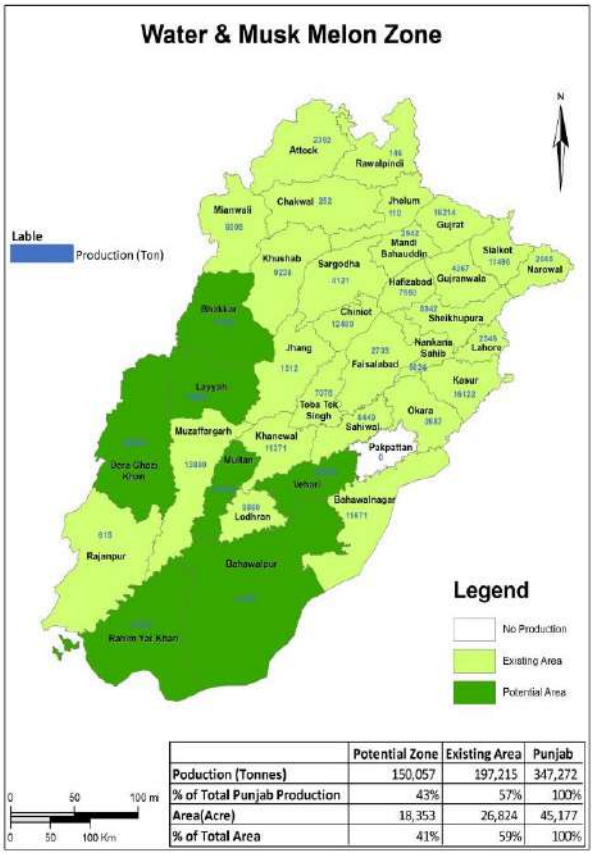
Based on the above-described conditions, the following crops have been identified as suitable for the Faisalabad division; Wheat, Rice, Guava, Oilseeds (Rapeseed, Canola, Sunflower & Sesamum), Sugarcane, Bitter and Apple gourd, Lady finger, Garlic, Citrus, Dates, Pulses, Matter peas, Water Melon, Cucumber and mixed vegetables. In this regard, production, yield & value, and logistics analysis of the Faisalabad division are discussed below.

1.6.10. PRODUCTION ANALYSIS

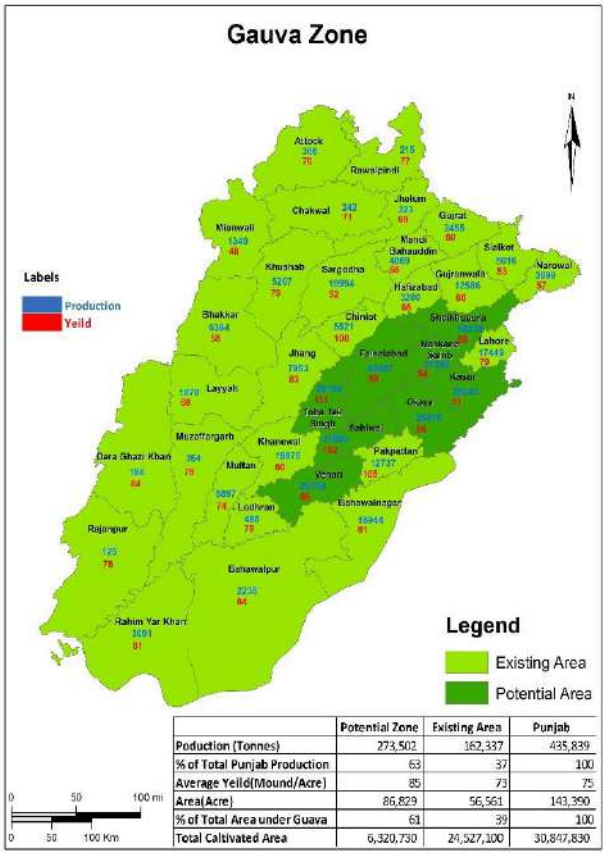
The potential crops zone based on these agroecological conditions is shown on the map (figure 18). These zones are identified based on comparative advantages in yield, production, and agroecological conditions.

For example, Rice is chosen for all four districts of Faisalabad region, Guava for Faisalabad and Toba tek singh districts, Oilseeds for all three districts except Chiniot. Likewise, we have identified specific high-yielding locations for each crop as shown in the map along with potential clusters for each crop clearly showing the current cultivated areas vs. the increased area that needs to be cultivated for certain crop/cluster where a specialized support system is to be provided.

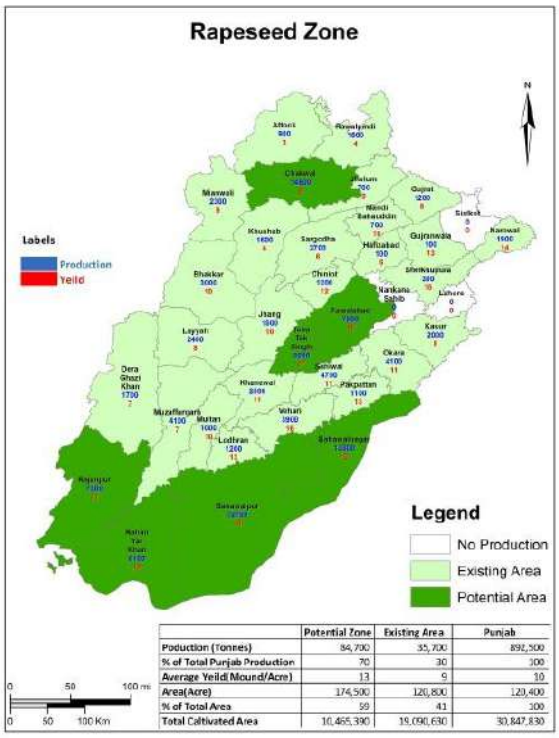
1.6.10.1. PRODUCTION AREA MAPPING



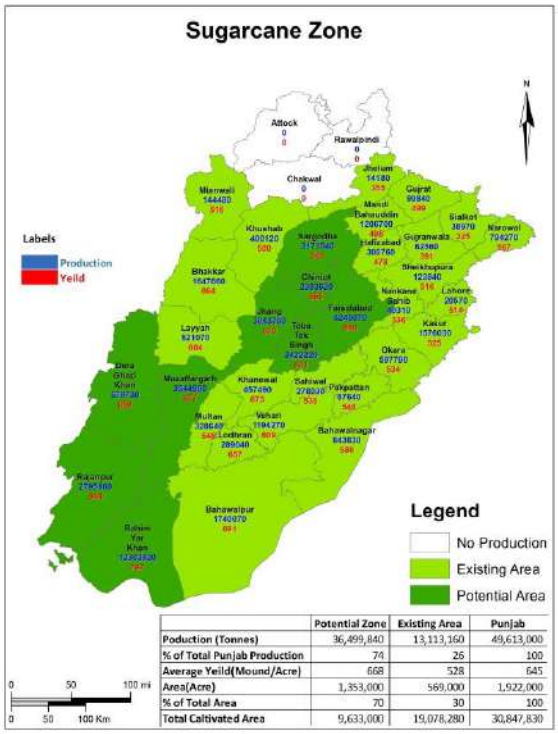
	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	150,057	197,215	347,272
% of Total Punjab Production	43%	57%	100%
Area(Acre)	18,353	26,824	45,177
% of Total Area	41%	59%	100%



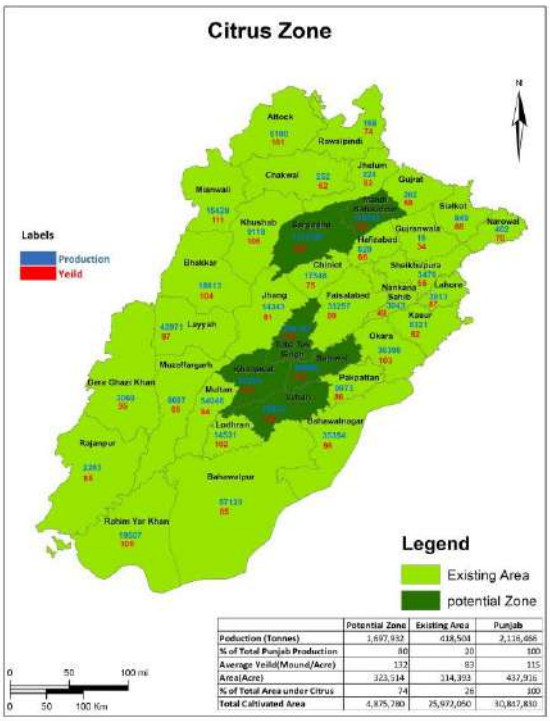
	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	273,502	162,337	435,839
% of Total Punjab Production	63	37	100
Average Yeild(Mound/Acre)	85	73	75
Area(Acre)	86,829	56,561	143,390
% of Total Area under Guava	61	39	100
Total Caltivated Area	6,320,730	24,527,100	30,847,830



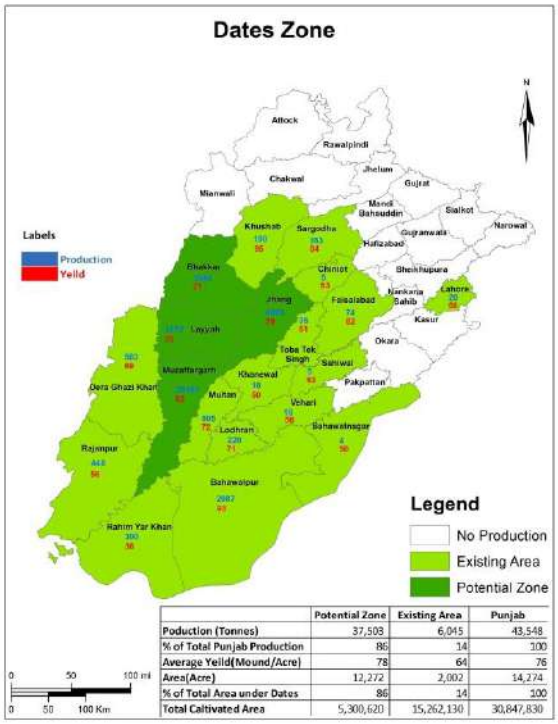
	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	84,700	35,700	892,500
% of Total Punjab Production	70	30	100
Average Yeild(Mound/Acre)	13	9	10
Area(Acre)	174,500	126,800	129,400
% of Total Area	59	41	100
Total Caltivated Area	10,455,390	19,090,630	30,847,830



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	36,499,840	13,113,160	49,613,000
% of Total Punjab Production	74	26	100
Average Yeild(Mound/Acre)	668	528	645
Area(Acre)	1,353,000	569,000	1,922,000
% of Total Area	70	30	100
Total Caltivated Area	9,633,000	19,078,280	30,847,830



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	1,697,932	618,504	2,116,666
% of Total Punjab Production	80	20	100
Average Yeild(Mound/Acre)	132	83	115
Area(Acre)	323,514	114,393	437,916
% of Total Area under Citrus	74	26	100
Total Caltivated Area	4,875,780	25,972,050	30,847,830



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	37,503	6,045	43,548
% of Total Punjab Production	86	14	100
Average Yeild(Mound/Acre)	78	64	76
Area(Acre)	12,272	2,002	14,274
% of Total Area under Dates	86	14	100
Total Caltivated Area	5,300,620	15,262,130	30,847,830

Figure 12: Production Area Mapping
Source: Urban Unit

1.7. WAY FORWARD

The agriculture sector has a strong linkage with food security and the growth of other sectors of the economy. The present situation of the Faisalabad region needs a high priority for the growth of the agriculture sector on a sustainable basis and requires the implementation of the most appropriate interventions to achieve the desired outcome. The Faisalabad Rabi/Kharif patterns for the growth of agriculture will further need improvement in its output and capacity-building training to trickle down to farmers. The emphasis is on the use of the better quality seed, and modern technologies to ameliorate agriculture outlook and food security.

The overall goal of the livestock sector strategy for the Faisalabad region is to contribute toward poverty alleviation and economic development of the province of Punjab through the provision of an enabling environment and support services for enhancing value addition, and value chain development, enhancing exports, and profitability of the livestock sector.

Livestock is an integral part of the agricultural system in Pakistan. However, with innovative approaches, livestock financial instruments need to be developed to route the finances of milk producers via the middlemen. In addition, agroforestry can also be included in future research studies and reports.

1.7.1. PROPOSED CROPPING PATTERN

Based on agro-ecological conditions, production, yield & value, and logistics analysis mentioned above, 16 crops are recommended for this region. Following value chains of the recommended crops in this region are proposed that are discussed below.

Figure 13 & 14 shows the spatial location of Rabi and Kharif crops for the Faisalabad division. For Rabi season Wheat, Citrus, Gram, Peas, Water Melon, Rapeseed/ Sunflower and Vegetables whereas Sugarcane, Rice, Moong/Dates, Lady finger, Cucumber, Guava, Sesamum/ Soyabean and other vegetables are proposed for Kharif season. Specific clusters for each crop are identified as shown on the map. There is a need to increase the area of each crop in the specified cluster as calculated in the map and provide a specialized support system from seed to the international market in each cluster. It will ensure efficient use of resources and increase each crop yield & water efficiency and adoption of good agriculture practices as per international standards.

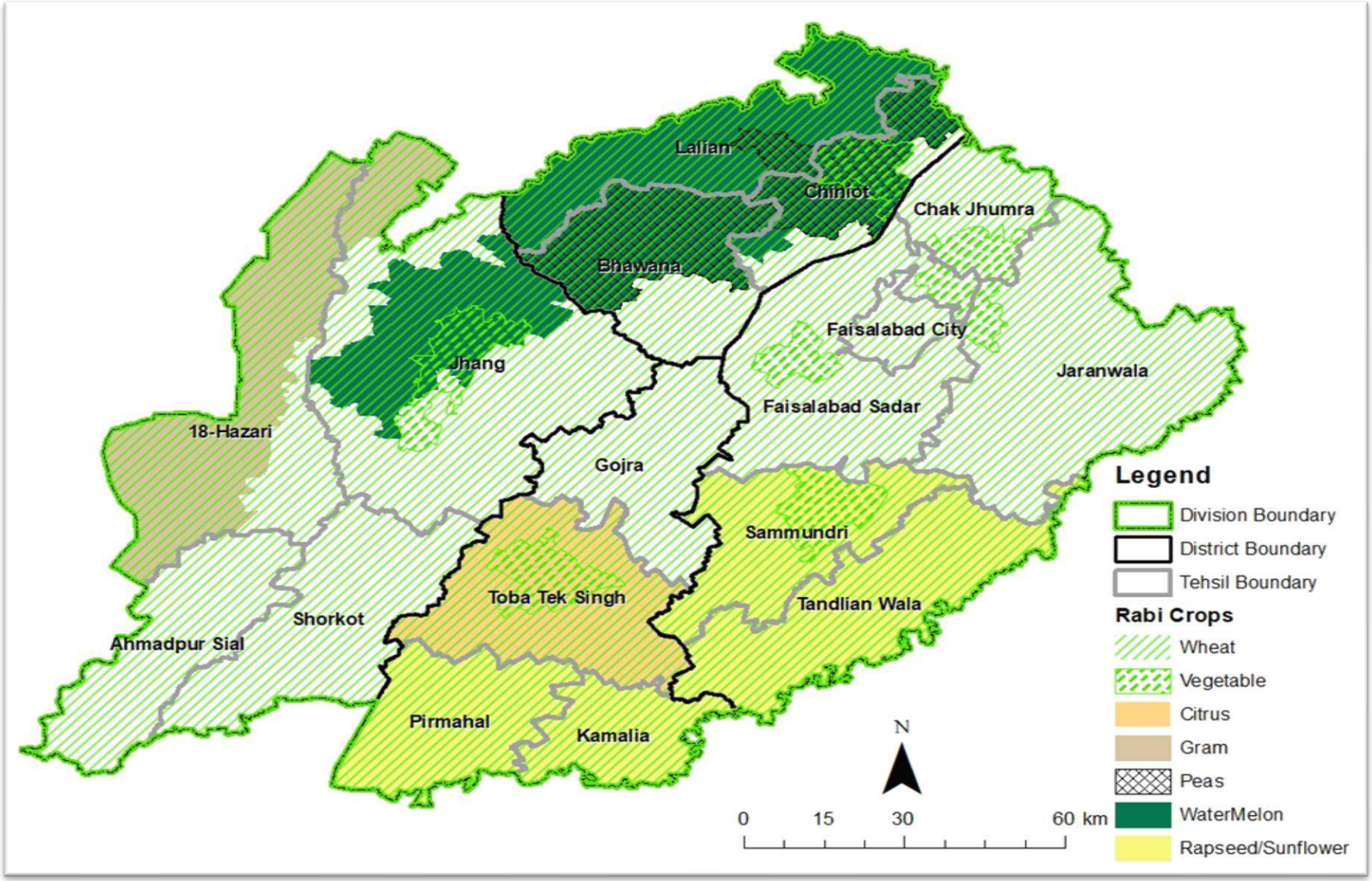


Figure 13: Proposed Cropping Pattern of Rabi Crops
Source: The Urban Unit

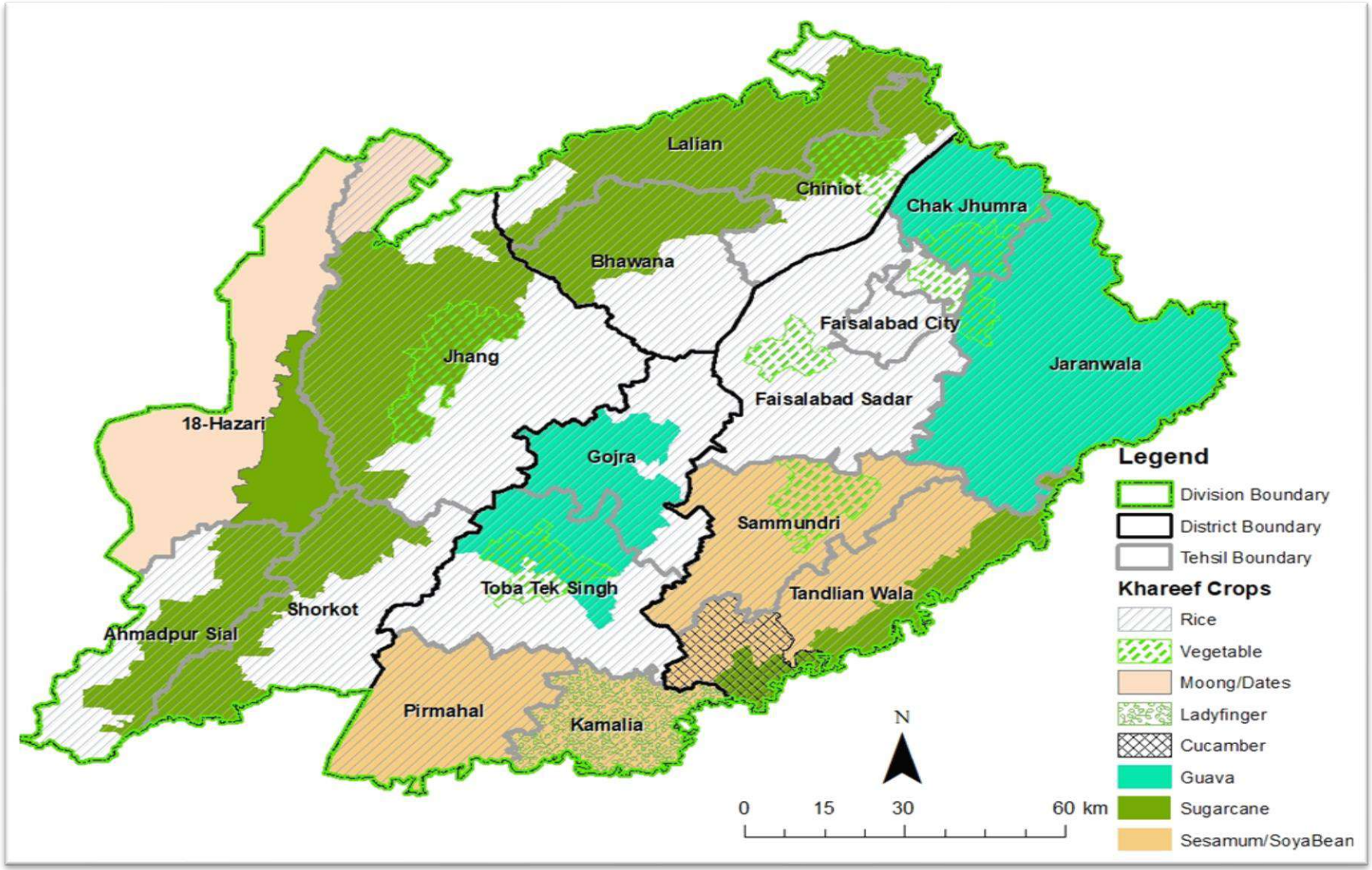


Figure 14: Proposed Cropping Pattern of Rabi Crops
Source: The Urban Unit

1.7.2. IMPACT OF PROPOSED CROPPING PATTERN

The impact of the proposed cropping pattern discusses that the main focus of this plan is on the value chain development through crop zoning.

Considering the analysis highlighted above, the main target is to increase the crop yield of division at least up to the level of progressive farmers, to gain surplus, increase exports and create sustainable value addition.

Below table 10 demonstrates the potential of various proposed crops. Thus, if we achieve a yield of the progressive farmer, better quality, and proper market strategy then we can increase the Faisalabad agriculture GDP from Rs. 282 Billion to Rs. 585 Billion.

However, more efforts are required to increase the yield of pulses and grams. Whereas, high-value crops like citrus, dates, and vegetables have the potential. Therefore, sincere interventions are needed to increase their area, and a provision of specialized support systems is also necessary to develop the value chain of these proposed crops.

Table 6: Impact of Proposed Cropping Pattern

Crops	Current Area	Proposed Area	Current Yield md/acre	Potential Yield Mnd/acre	Current Value	Potential Value (PKR)
Wheat	1,942,000	1,942,000	34	70	128,236,387,500	265,083,000,000
Rice	698,000	698,000	24	60	30,100,500,000	75,384,000,000
Guava	19,567	39,134	104	462	2,432,700,000	21,695,889,600
Rapeseed	70,600	88,250	19	25	2,242,660,000	3,662,375,000
Canola	6,426	15,000	17	27	172,080,000	648,000,000
Watermelon	25,234	30,000	411	415	4,667,872,500	5,602,500,000
Sugarcane	561,000	561,000	734	1,100	97,166,628,000	145,635,600,000
Bitter Gourd	2,394	5,000	163	400	781,600,000	4,000,000,000
Lady Finger	11,008	25,000	146	180	3,388,944,000	7,020,000,000
Apple Gourd	1,596	5,000	138	162	264,570,000	972,000,000
Garlic	3,929	10,000	75	140	707,100,000	3,360,000,000
Citrus	50,734	100,000	190	400	11,562,600,000	48,000,000,000
Dates	155	2,000	65	250	28,000,000	1,400,000,000
Sesamum	64,529	80,000	6	20	663,720,000	2,560,000,000
Sunflower	295	2,000	20	40	12,426,180	171,840,000
		Total			**282,427,788,180**	**585,195,204,600**

Source: Crop Reporting Service

1.8. VALUE CHAIN ANALYSIS

Agri-food Value Chains are designed to increase competitive advantage through collaboration in a venture that links producers, processors, marketers, food service companies, retailers, and supporting groups such as shippers, research groups, and suppliers.

The stages involved in the process of value-chain are: The first is input supply, then production, collection, processing, and then retailing. The intermediaries are the actors in the chain that are involved at each stage that belongs to local and interprovisional commissions. In some cases, the same actor may be involved in more than one stage. The diagram also represents the institutions that help support the actors in the value chain.

Based on the value chain framework, various value-chains are devised for each crop which helps in explaining the analysis, strategy development, planning, and implementation and also presents a bird's eye view of the analytical stage of the proposed value chain projects. Following value chains of the recommended crops in this region are proposed are discussed below.

On-Farm	Livestock
• **Dates** • **Citrus** • **Wheat** • **Sugarcane** • **Gram** • **Oilseed - Canola**	• **Meat** • **Dairy**

1.8.1. WHEAT VALUE CHAIN

Wheat is one of the four main crops in Pakistan (i.e., rice, cotton, and sugarcane), with 80 percent of farmers growing it on an area of around 9.0 million hectares (close to 40 percent of the country's total cultivated land) during the winter or "Rabi" season. Marketing year (MY) 2019/20 wheat production is forecast at 25.6 million metric tons, two percent higher than the revised wheat production of 25.1 million metric tons, a year ago mainly due to conducive weather conditions and appropriate rainfall during the growing season.

i. GLOBAL WHEAT PRODUCTION

The main producing countries of wheat include India, China, the United States, Russia, and Pakistan of which Pakistan is at the 6th position globally.

According to data from the Food and Agriculture Organization of the United Nations (FAO), global wheat production reached an all-time high of 764 million metric tons in the 2020/2021 marketing year, up from 748 million metric tons the previous year. The increase in production was largely due to improved yields in major producing countries, including China, India, and Russia.

The top five global wheat producing countries in 2020/2021 were China, India, the United States, Russia, and France, together accounting for over half of the world's total production. In terms of exports, the largest exporters of wheat are the United States, Russia, Australia, Canada, and France, which together make up a significant portion of the global trade in wheat.

Overall, global wheat production is important for meeting the food and feed needs of a growing population, as well as for supporting economic development in many countries. The stability and sustainability of wheat production is influenced by many factors, including weather conditions, government policies, market conditions, and advances in agricultural technology, and it is important to monitor and understand these factors in order to ensure the continued availability of wheat for food and feed purposes.

Although Pakistan produced a record wheat crop of 26.7 million tonnes in the 2021 year, it was insufficient to meet the country's domestic consumption requirements and maintain large strategic reserves, according to a recent Global Agricultural Information Network report from the Foreign Agricultural Service of the US Department of Agriculture (USDA).

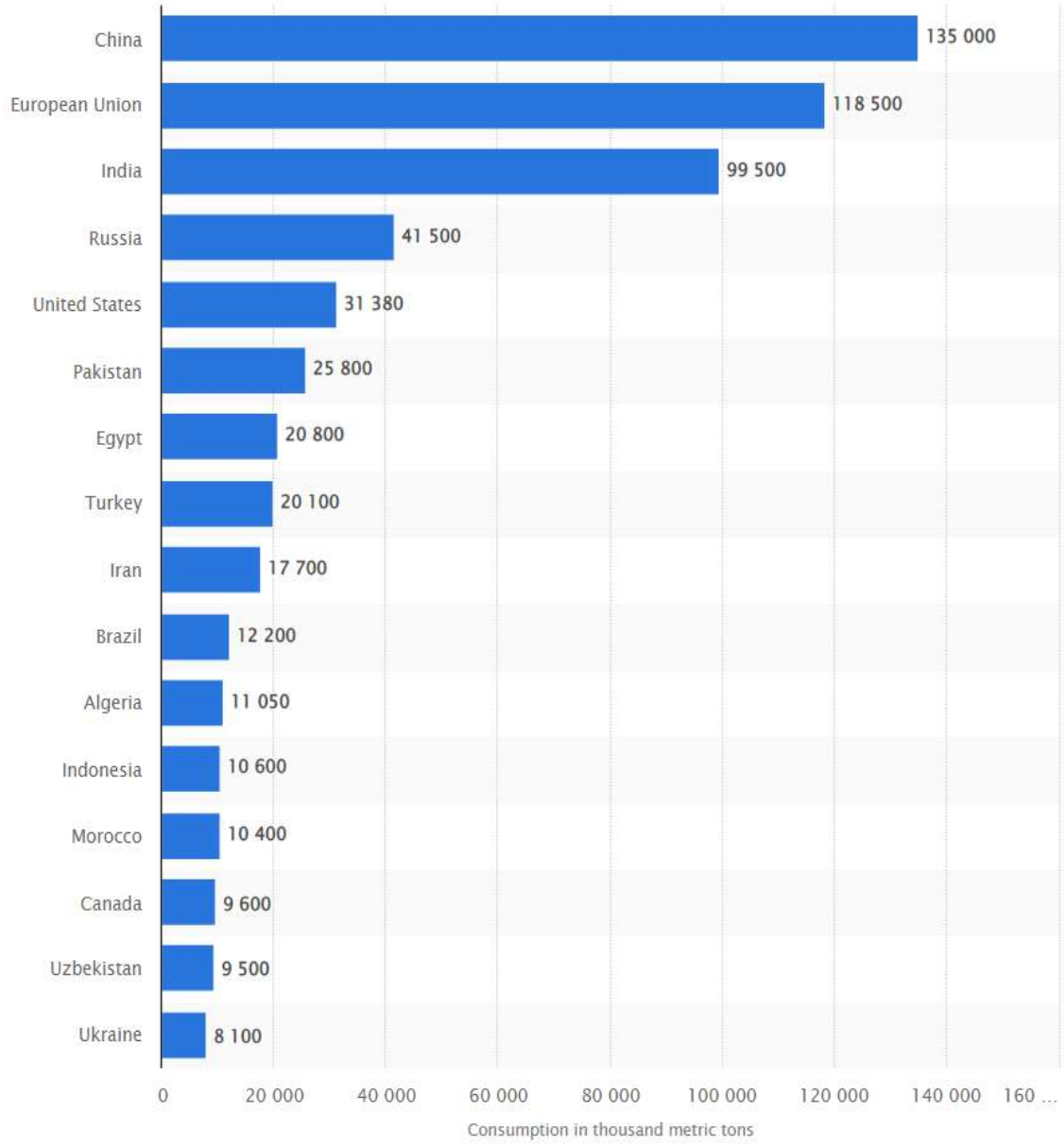


Figure 15: Global Wheat Production
Source: Statista

In the marketing year of 2019/2020, the global production volume of wheat amounted to over 765 million metric tons. This was an increase of over 30 million tons compared to the previous marketing year.

Leading world wheat exporting countries (2001–2020) are shown below in the figure. Australia, Argentina, Canada, France, Kazakhstan, Russia, Ukraine, and the USA are the largest wheat exporting countries in the world. In 2020, they accounted for 153 million tons of wheat exports, which corresponds to 77% of the total wheat exports this year. Abbreviation: ROW, rest of the world.

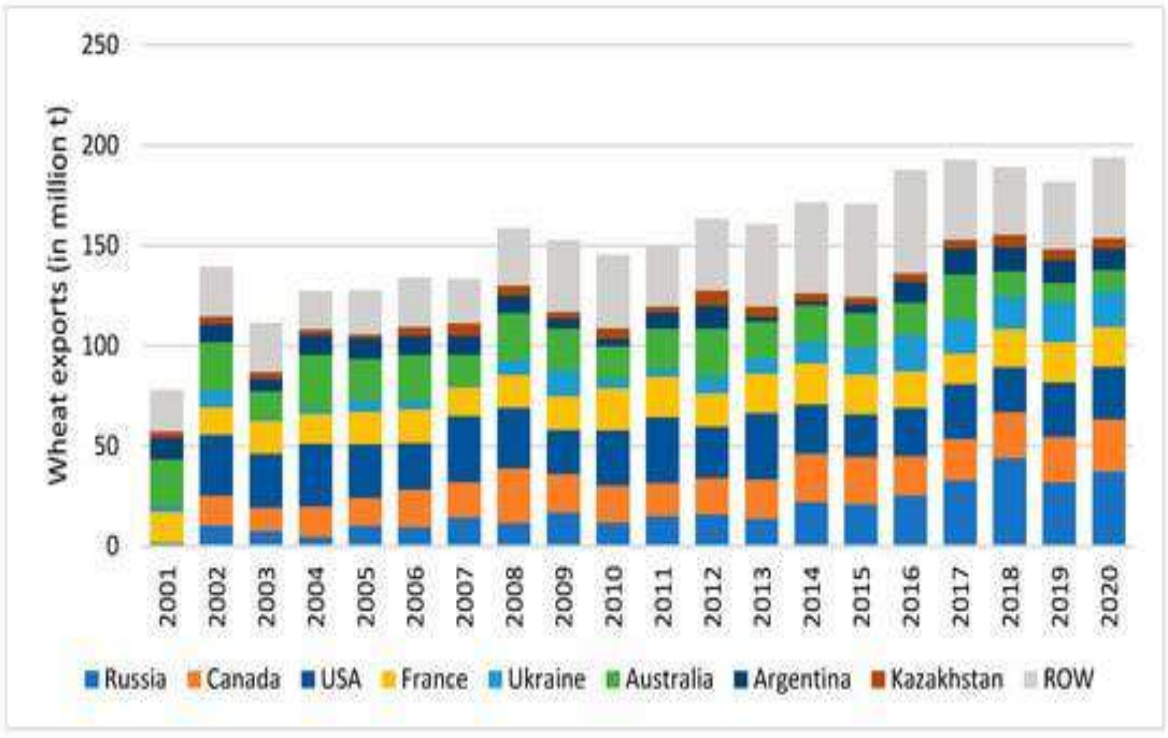


Figure 16: Global Wheat Exports
Source: Trade Map

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ii. CHALLENGES AND ISSUES

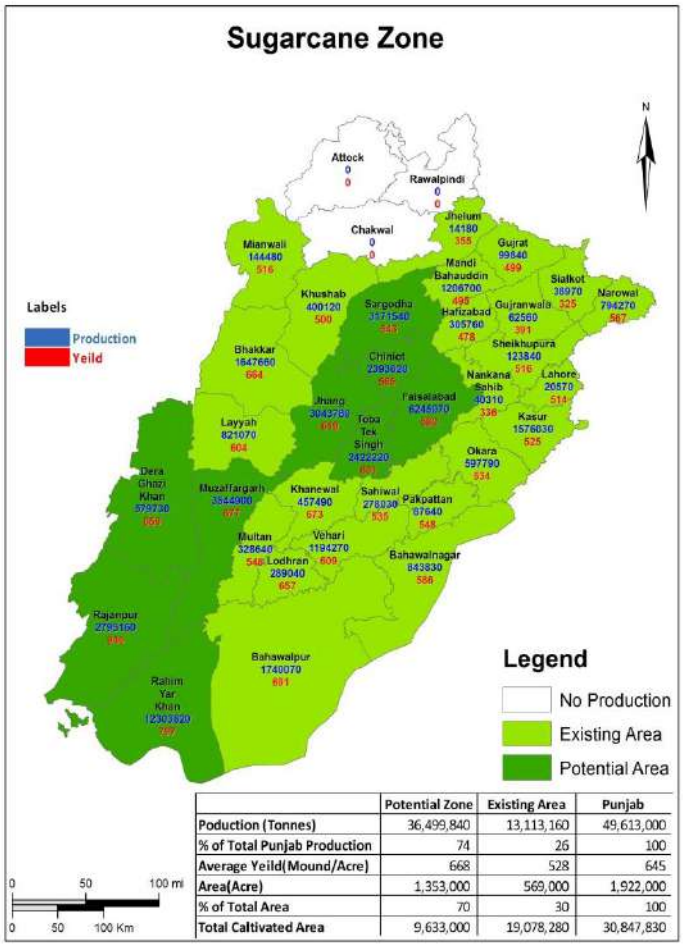
Inputs	Production	Harvest	Markets & Logistics
Unavailability of quality seed	The limited capacity of farmers	Re-evaluation of optimum sowing time in various ecologies considering the prevailing climatic changes	Poor marketing infrastructure
Delayed Planting	Spread of diseases		Lack of marketing campaign for local consumption
Lack of quality wheat	Lack of extension Services and technical assistant		Lack of market research/ market identification
Soil Salinity	Poor pest/disease management	Quality assurance mechanisms and standardized certifications for export are missing.	Poor access to the high-end market
Lack of irrigated water supplies	Drought/ Terminal heat stress		Lack of presence at international exhibitions/ trade shows
Water Shortage	Water Infestation		Lack of support from trade counselors posted abroad in opening new markets/relationship management in existing markets
Low-quality pesticide	Non-availability of soil moisture in rainfed areas delays wheat sowing	Lack of modern Harvesting technologies	
	Improper land leveling	Access to finance problem	
	Drainage problems		
	Agronomic constraint	Low and inadequate quality of existing storage facilities	
	Inefficient fertilizer use		The transportation supply chain needs to be made efficient
	Imbalance uses of Nutrition	Post-Harvest Losses	

iii. RECOMMENDATIONS

Inputs	Farms Management & Zoning	Marketing & Access to Finance
Availability of Seed of Recommended Varieties	Availability of skilled and trained labor	Establishment of Research Collaboration/Linkages
Availability of inputs (fertilizers, herbicides, electricity, diesel, etc.)	Farm Mechanization	Annual Wheat Meeting to discuss strategies to enhance the wheat production
To increase yield potential, introduce Germplasm Acquisition, Evaluation, and Distribution	Awareness and training of farmers on standardized Wheat farming management and improved irrigation practices	Traveling Wheat Seminar activity of coordination to bring all stakeholders in close contact
Timely availability of water	Training of labor on the usage of processing equipment	Improved local markets, & international linkages
On-going varietal development based on market research	National Uniform Testing and Variety Release for Agro-ecological zones.	Provide an incentive for setting up new industries
Seed replacement programs.	Technology Transfer to developing decision support systems that could provide site-specific recommendations/ guidelines	Agricultural credit for realizing the production target of any crop
Special program for the Seed Companies for certified wheat seed production.	Subsidy on implements for wheat.	
Implementation of amended seed act for wheat varieties registration.	Development of Smart tools for mechanization especially for small farmers.	
To develop climate-smart high yielding, rust, and heat stress-tolerant varieties of wheat.	Subsidy on Weedicide.	
Develop Linkages with academia and international researchers for R&D	Subsidy on gypsum & green manuring.	
	Provision of extension services	

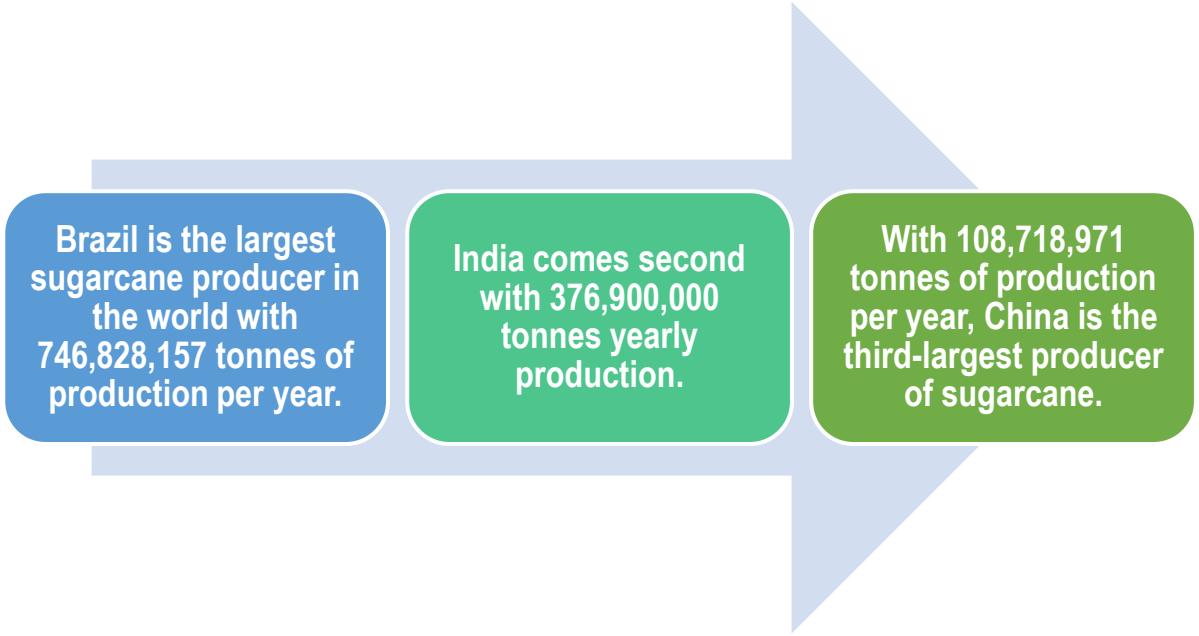
1.8.2. SUGARCANE VALUE CHAIN

According to the International Sugar Organisation, nearly 130 countries in the world participate in sugarcane and sugar beet production and have been providing the world with four major products including cane tops, bagasse, filter muds, and molasses. Being one of the easiest crops to grow, it has been providing countries with a sizable revenue, which has acted as a major growth driver for the global market. Since granulated sugar and liquid sugar are used in nearly all cuisines and in high amounts because of rapid urbanization, the demand for sugarcane is expected to increase. In 2018, the global sugarcane market size stood at $23.60 billion. During the forecast period 2019–2025, the sugarcane market is deemed to grow at a compound annual growth rate (CAGR) of 1.80% ("Pakistan Sugarcane Market Research Report: Market Size, Industry Outlook, Market Forecast, Demand Analysis, Market Share, Market Report 2021-2026" n.d.).



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	36,499,840	13,113,160	49,613,000
% of Total Punjab Production	74	26	100
Average Yeild(Mound/Acre)	668	528	645
Area(Acre)	1,353,000	569,000	1,922,000
% of Total Area	70	30	100
Total Caltivated Area	9,633,000	19,078,280	30,847,830

iv. GLOBAL PRODUCTION OF SUGARCANE



	Country	Production (Tons)	Production per Person (Kg)	Acreage (Hectare)	Yield (Kg / Hectare)
	Brazil	746,828,157	3,564.251	10,042,199	74,369
	India	376,900,000	282.009	4,730,000	79,682.9
	China	108,718,971	77.998	1,414,973	76,834.7
	Thailand	104,360,867	1,508.472	1,372,169	76,055.4
	Pakistan	67,173,975	332.755	1,101,948	60,959.4
	Mexico	56,841,523	455.688	785,905	72,326.2
	Colombia	36,276,860	726.569	408,716	88,758
	Guatemala	35,568,207	2,055.718	300,246	118,463.7
	Australia	33,506,830	1,337.63	442,958	75,643.4
	United States of America	31,335,984	95.605	364,096	86,065.2

Figure 17: Global Sugarcane Production (2018-2020)
Source: World Population Review

Pakistan's Marketing Year (MY) 2020/21 sugar production is forecast at 5.9 million metric tons (MMT), a six percent increase from the current year's revised estimate due to an expected increase in sugarcane area. Sugar consumption for the same year is forecast at 5.8 MMT, moderately higher than last year's estimates, and exports are forecast at 400,000 metric tons. Ending stocks are expected to decrease to 1.9 MMT. The current year's production estimates are revised slightly from last year mainly due to an increase in productivity. MY 2018/19 sugar exports stand at 600,000 tons mainly due to a subsidy of $35 per metric ton provided to sugar exporters. Sugar prices jumped 33 percent in March 2020 compared to the same period last year.

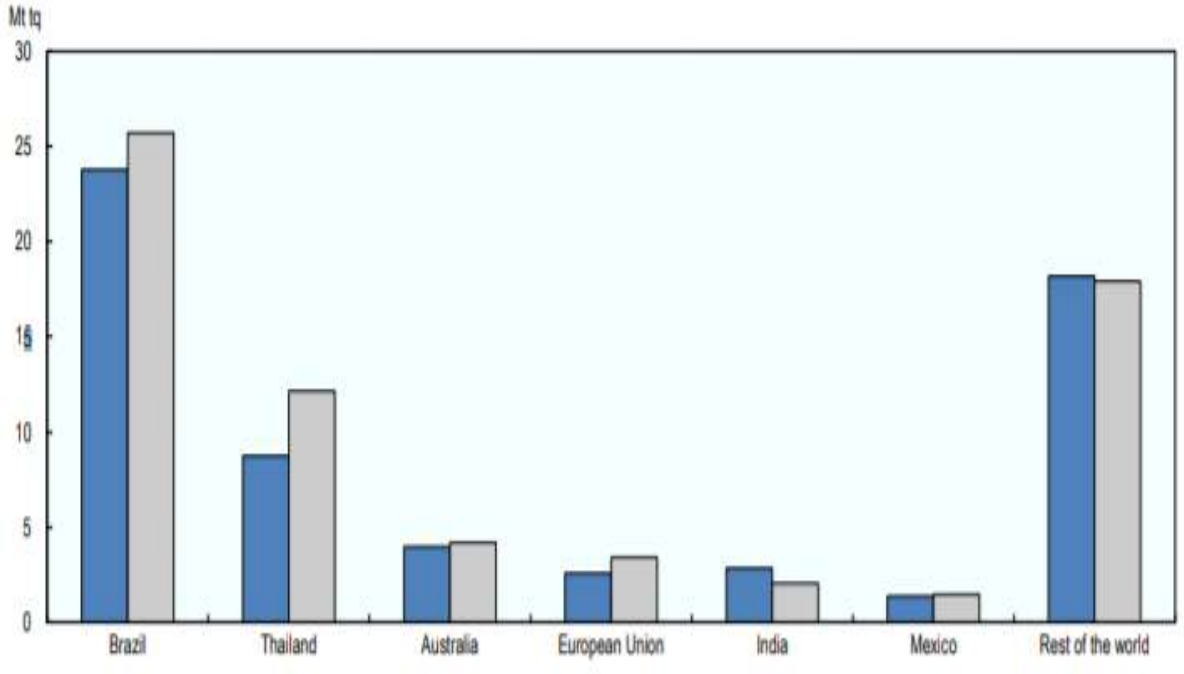


Figure 18: Pakistan Exports of Sugars and Sugar Confectionery
Source: OECD Agriculture statistics 2019

Pakistan is the fifth largest sugarcane producer in the world with an annual production of 63,800 thousand metric tons (TMTs), after Brazil, India, China, and Thailand. Pakistan's marketing year (MY Oct/Sep) 2021/22 sugarcane production is forecast at **83 million metric tons** (MMT), up to ten percent from the revised 2020/21 estimate, due to an increase in area and sugarcane yields.

Pakistan is one of the largest producers of sugarcane in the world, and the Faisalabad division is an important center of sugarcane production in the country. Sugarcane is a major crop in the region, and its cultivation provides employment and income opportunities for local farmers, as well as contributing to the local and national economy through the production of sugar.

The total area under sugarcane cultivation in the Faisalabad division can vary from year to year, depending on factors such as weather conditions, disease and pest pressure, government policies, and market conditions. In recent years, there has been a trend towards increased cultivation of sugarcane in the region, as the demand for sugar continues to grow both domestically and internationally.

In terms of yield, the productivity of sugarcane in the Faisalabad division can also be influenced by factors such as the quality of seed, the use of fertilizers and other inputs, and the application of modern agricultural practices. The average yield of sugarcane in the region can range from 60 to 80 tons per hectare, depending on the specific growing conditions and the type of sugarcane variety being grown.

Overall, the sugarcane production in the Faisalabad division is an important contributor to the local and national economy, and it is essential to monitor and understand the various factors that impact its cultivation and productivity in order to ensure its continued success. This may involve investing in research and development to improve seed varieties, encouraging the adoption of modern agricultural practices, and addressing challenges such as disease and pest pressures, water scarcity, and labor shortage.

v. CHALLENGES AND ISSUES

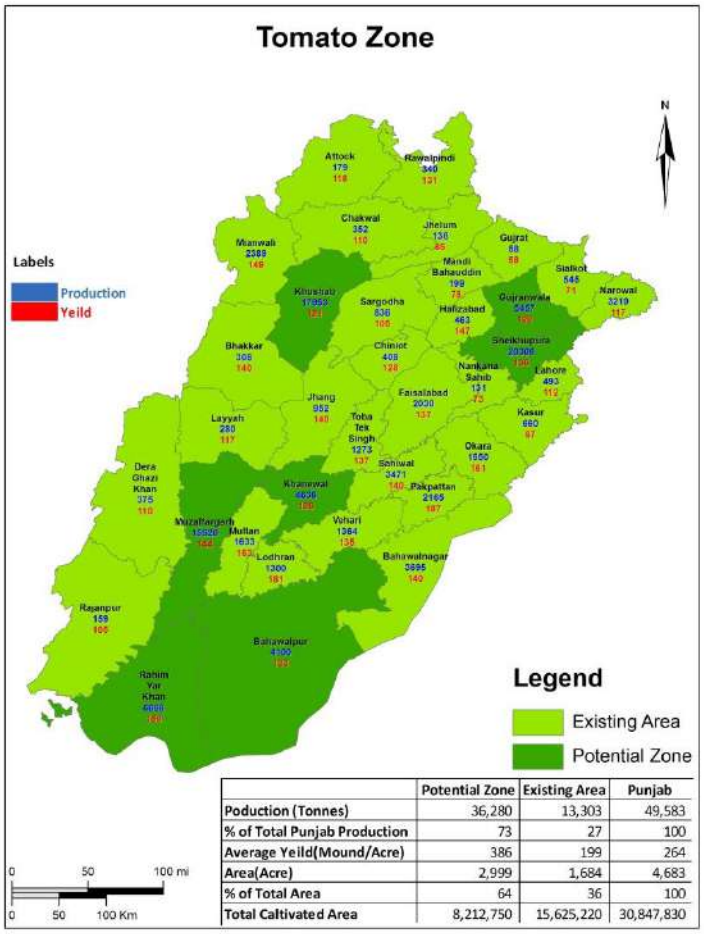
Inputs	Production	Harvest	Markets & Logistics
Non-availability of drought and salt-tolerant sugarcane varieties Low seed rate Poor plant protection measures Weak varietal development program Increase in cost of inputs	Only 50-60% area is under approved good quality varieties Improper pest management Low quality of pesticide. Lack of extension Services and technical assistant Poor land preparation Climate changes Control on the spread of unapproved and low sugar content varieties (CO-1148 in KPK, SPF-238 in Punjab & Disco in Sindh)	Lack of modern technology Access to finance problem Low-quality cane procurement system i.e. mainly through a middleman Harvesting delay due to late crushing	Role of the middle man. Lack of regulation Poor marketing infrastructure Lack of marketing campaign for local consumption Lack of market research/ market identification Poor access to the high-end market Untimely payments to farmers by the sugar mill

vi. RECOMMENDATIONS

Inputs	Farms Management & Zoning	Marketing & Access to Finance
Development of climate-smart high-yielding varieties. DNA & all other required testings for mother plant and scion varieties Identification of demand in the international and local market Control of diseases Introduction of different varieties planted may be harvested according to their maturity. Germplasm Acquired/Distributed to date Availability of cheap and efferent Pesticides	Showcasing of Good Agricultural Practices (GAP) on balanced use of fertilizer, Weedicide application, and Integrated Crop Management (ICM). Promotion of water-saving technologies. Promotion of Intercropping, September Planting, and Chip Bud Technology. Availability of skilled and trained labor Adopt modern sugarcane harvesting technology, strengthening support services. Upgradation of Sugarcane Research Institute and capacity building of their staff Selection of cane varieties having resistance against biotic and abiotic stresses, high yield, and sucrose contents to be accomplished. Provision of extension services	Sugarcane value addition enhancement program. Improved local markets, & international linkages Provide an incentive for setting up new industries Develop feasibilities for new value add industries Linkages with academia and international researchers for R&D Improvement in cane growers' economic condition by increasing productivity per unit area.

1.8.3. TOMATO VALUE CHAIN

Tomato is one of the most important vegetables in the world. It is important for cash and industrial crop in many parts of the world. Tomato is the most common and important kitchen item cooked as vegetables, used as condiments, and salad in Pakistan. The consumption of tomatoes has high-income elasticity of demand. Thus, there will be more demand for these vegetables with population growth, economic growth, and urbanization. Among the vegetables, tomato is one of the most important vegetables in terms of acreage, production, yield, commercial use, and consumption. It is used as a food item on daily basis and forms a very important component of food consumed in Pakistan. Pakistan had a 150 thousand ha area and 57094 tons production of tomato. Sindh is the highest tomato-producing province with tomatoes grown in an area of 67.46 thousand hectares followed by Balochistan with 31.38 thousand hectares of the area while Punjab had 18.29 thousand ha under tomato cultivation.



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	36,280	13,303	49,583
% of Total Punjab Production	73	27	100
Average Yeild(Mound/Acre)	386	199	264
Area(Acre)	2,999	1,684	4,683
% of Total Area	64	36	100
Total Caltivated Area	8,212,750	15,625,220	30,847,830

Productivity improvement always remains the main thrust of all the economies in the world. Increasing productivity leads to increasing trade. Innovations, productivity, and exports have strong relationships. Developed countries are leading in per hectare productivity due to the use of advanced technology. Developing countries are following the path of productivity

enhancement. Pakistan is a developing country with the fifth-most populous country. The majority of which is dependent on agriculture (67%) and 43.7 percent of the labor force is involved in the agriculture sector (GoP, 2014). Horticulture contributes 11% of the total value added to agriculture. Generally, yield of different crops is stagnant except for major crops in Pakistan. In horticultural crops, tomato occupies a major position.

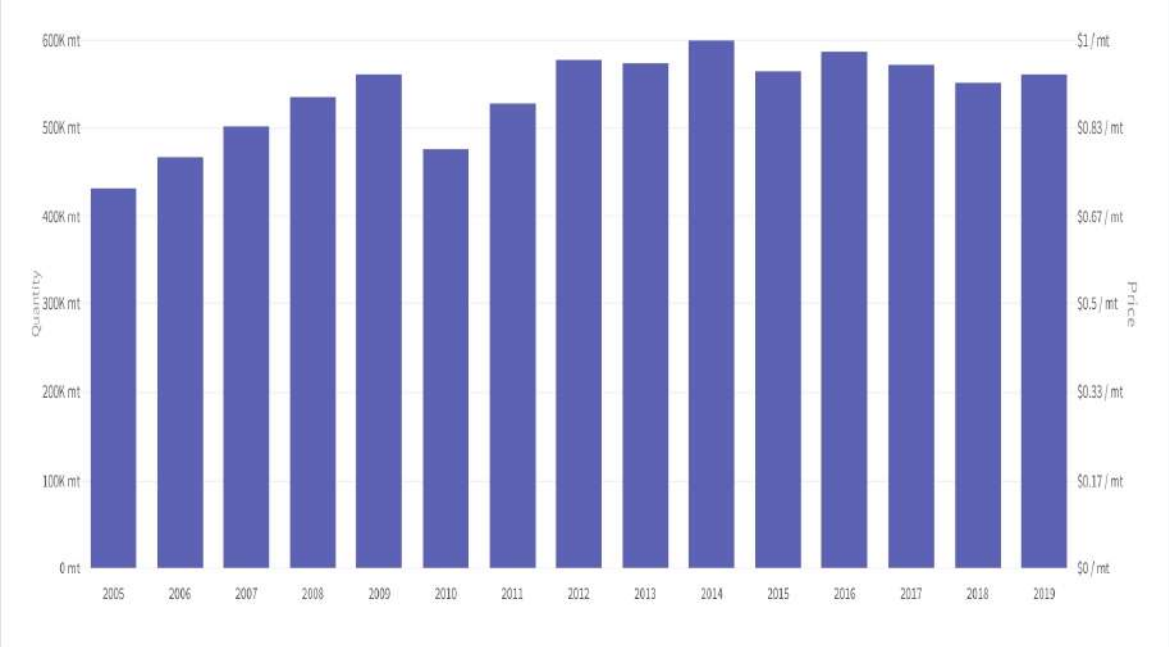
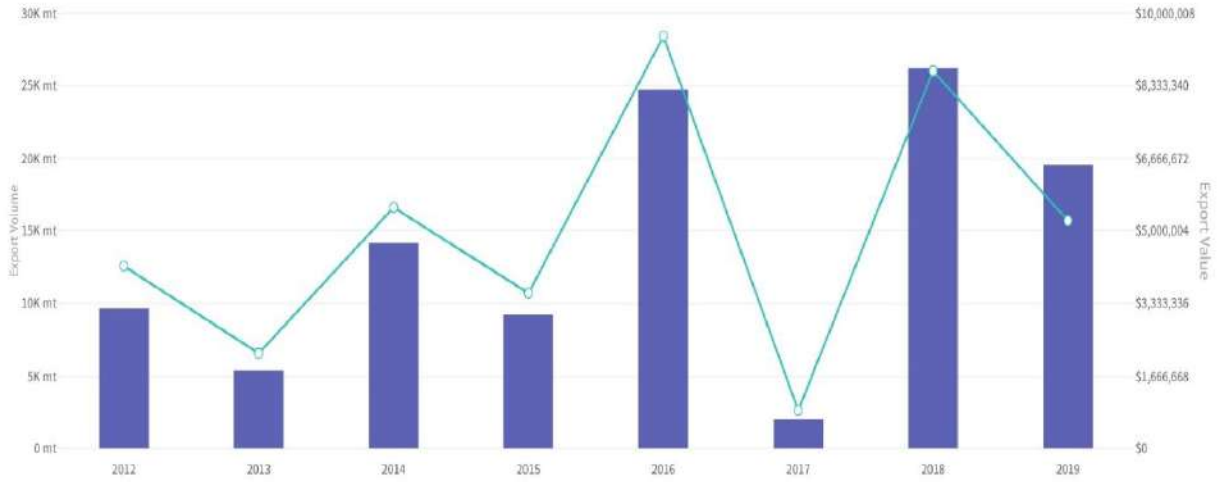


Figure 19: Tomato Production
Source: Statista

Pakistan earns only 28% of the world average export price suggesting great challenges in improving the tomato value chain. The country can export less than 1% of its production while the world average export-production ratio is 4.7%. Pakistan has great potential to improve its export-production ratio because of its lower farm gate prices than the world average.



Type	Unit	2012	2013	2014	2015	2016	2017	2018	2019
Export Value	USD	4.19M	2.19M	5.54M	3.57M	9.47M	879.48K	8.67M	5.23M
Export Volume	Metric Ton	9.72K	5.43K	14.18K	9.27K	24.79K	2.09K	26.30K	19.54K
Export Unit Price	USD / Metric Ton	431.29	403.04	390.44	385.25	381.82	421.80	329.75	267.74

Figure 20: Tomato Export
Source: Trade map

The global production of tomatoes is about 182 million tonnes obtained from 4.8 million ha with an average yield of 38 tonnes per ha. China and India are the leaders in global tomato production. Pakistan ranks 33rd among the tomato-producing countries. The global export of fresh tomatoes is worth US$ 8.8 billion, while the export of tomatoes and their products has reached over US$ 13 billion. Mexico leads the world in exports followed by Spain. The top importer of fresh tomatoes is the USA followed by Belgium and Russia.

vii. CHALLENGES AND ISSUES

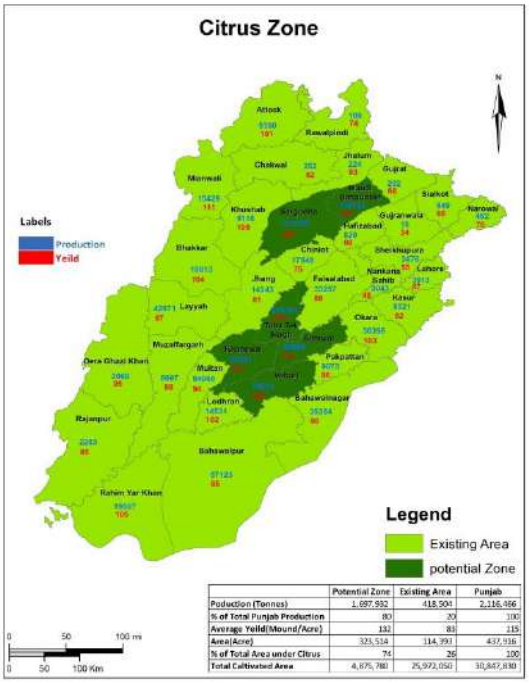
Inputs	Production	Harvest	Markets & Logistics
Expensive seeds Seed efficiency is 80 % No locally Produced Cheap seed available in the market Lack of institutional support to provide a database and inventorying of certified, disease-free seed plants. Unreliable supply of certified plants. Lack of registered nurseries Poor nursery management practices	Shortage of Skilled Labor. Most of the Production is in the Peri-Urban area due to the labor supply. Fail to meet Demand annually because of limited capacity. Inadequate supply of plants required for new zones. No disease-free zones were identified for new plantation Low quality of pesticide. Low Prices in the local market Lack of extension Services and technical assistant Poor pest/disease management Imbalance uses of Nutrition	Post-Harvest Losses up to 20% Incorporate modern harvesting technologies Inadequate and scarcity of existing facilities for Grading, Polishing, and sizing for local market demands. Quality assurance mechanisms and standardized certifications for export are missing. Lack of modern technology Access to finance problem Perishable goods and no storage capacities No Pulping unit nearby.	Role of the middle man. Lack of regulation Poor marketing infrastructure Lack of marketing campaign for local consumption Lack of market research/ market identification Poor access to the high-end market Lack of presence at international exhibitions/ trade shows Lack of support from trade counselors posted abroad in opening new markets/relationship management in existing markets

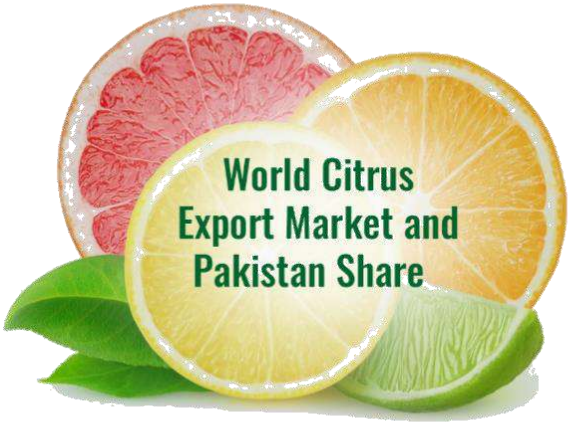
viii. RECOMMENDATIONS

Inputs	Farms Management & Zoning	Marketing & Access to Finance
Availability of Cheap and HYV seeds in the market	Increasing cropping area and Declaring peri-urban areas to be Tomato zones.	Developing state-of-the-art Cold-Storage
VRI to develop new seed varieties	Availability of skilled and trained labor	Improved local markets, & international linkages
DNA & all other required testing are for mother plant and scion varieties	Farm Mechanization	Provide an incentive for setting up new industries
Identify protocol for export of tomatoes to the various markets.	Availability of cheap and efferent Pesticides	Providing Pulping Units
Upgradation of VRI and capacity building of their staff	Awareness and training of farmers on standardized Tomato farming management and improved irrigation practices	Availability of alternative Value addition Products of Tomatoes.
Linkages with academia and international researchers for R&D	Training of labor on Grading, Sorting, Packaging, usage of processing equipment	Develop packaging manufacturing industry for fresh fruit
Timely availability of water and other inputs	Provision of extension services	Develop local manufacturing industry to manufacture Grading/Sorting/Packing lines
		Develop a zoning-based state-of-the-art trading market.
		Identification of demand in the international and local market

1.8.4. CITRUS VALUE CHAIN

Pakistan is producing more than 30 types of different fruits of which citrus fruit is leading among all fruit and constitutes about 30% of total fruit production in the country. Above 90% of citrus fruits are produced in Punjab province and distributed through different value chains in domestic as well as international markets. A large part of citrus fruit produced in Pakistan is mostly consumed locally without much value addition; however, 10–12% of total production is exported after value addition.





	Pakistan	World
CITRUS PRODUCTION	2.13 (Million Tons) (1.2%)	153 (Million Tons)
CITRUS EXPORT (FRESH)	0.468 (Million Tons) 177 (USD Million) (2.7%)	17.3 (Million Tons) 14.7 (USD Billion)
ORANGE JUICE (EXPORT)	-	153 (Million Tons) 5.26 (USD Billion)
PULP	6,743 (Tons) 11.5 (USD Million) (0.6%)	17.3 (Million Tons) 14.7 (USD Billion)

Figure 21: Citrus Export Market Share
Source: Trade map and FAO

In Pakistan citrus fruits are the most important fruit crops grown on an area of approximately 160,000 hectares with a production of 2.13 MMT annually, making it the 14th largest producer with global exports share of 2.7% making it the 19th largest exporter in terms of value and 10th largest in terms of quantity. It is grown in all four provinces of Pakistan, but Punjab produces over 95% of the crop because of its greater population, favorable growing conditions, and adequate water, in Sargodha, it is mainly grown in Sargodha, & Bhakkar District. Citrus is divided into different groups Sweet oranges, Mandarine, Grapefruit, Lemon, and Lime which are being grown commercially.

World citrus production is increasing at 2.24% per annum, there is a huge potential to increase citrus production, which can be achieved with accurate interventions. Similarly, exports are increasing by 2.57%, hence to remain in the top citrus exporting countries there is an urgent need for the Government to provide an enabling environment with the requisite interventions to enhance the productivity of citrus.

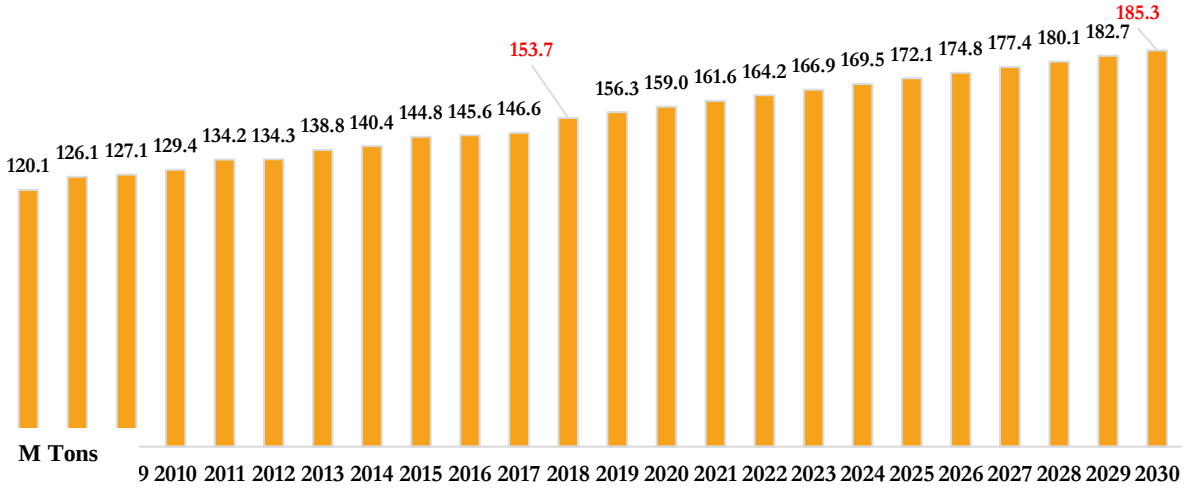


Figure 22: Citrus Production
Source: FAO

Pakistan ranks at number 10 among citrus exporting countries, Spain leading with 3,549,540 tons export value, there is a need to improve citrus quality to be among the top.

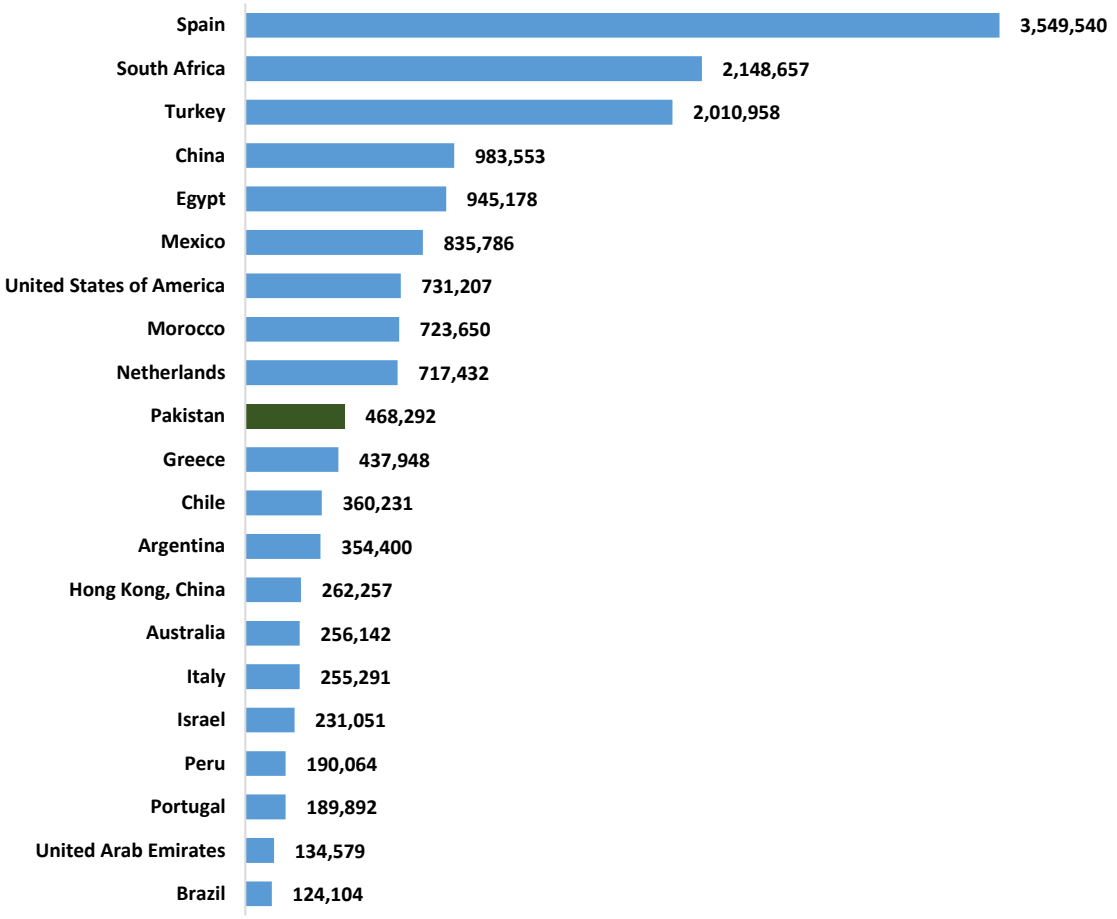


Figure 23: Citrus Exports
Source: Trade Map

Due to the low quality of citrus produced in Pakistan, it does not fall in the top 10 leading exporters when investigated by type of citrus exported, Pakistan only comes in the top 10 for Mandarin. Similarly, Pakistan produces extremely low yield (kgs/Acre) when compared to the top 3 countries' yield in all citrus types, there is a need to adopt good agriculture practices and high density in orchards.

Sargodha Citrus is primarily targeting the international export market; around 90% of the total citrus exports from Pakistan are being supplied. Important export markets for Pakistan kinnow are Afghanistan, Iran, Indonesia, Malaysia, Eastern European, and Russian Federation countries. To target and cater to the market, processors need to expand more and develop a network of traders and exporters.

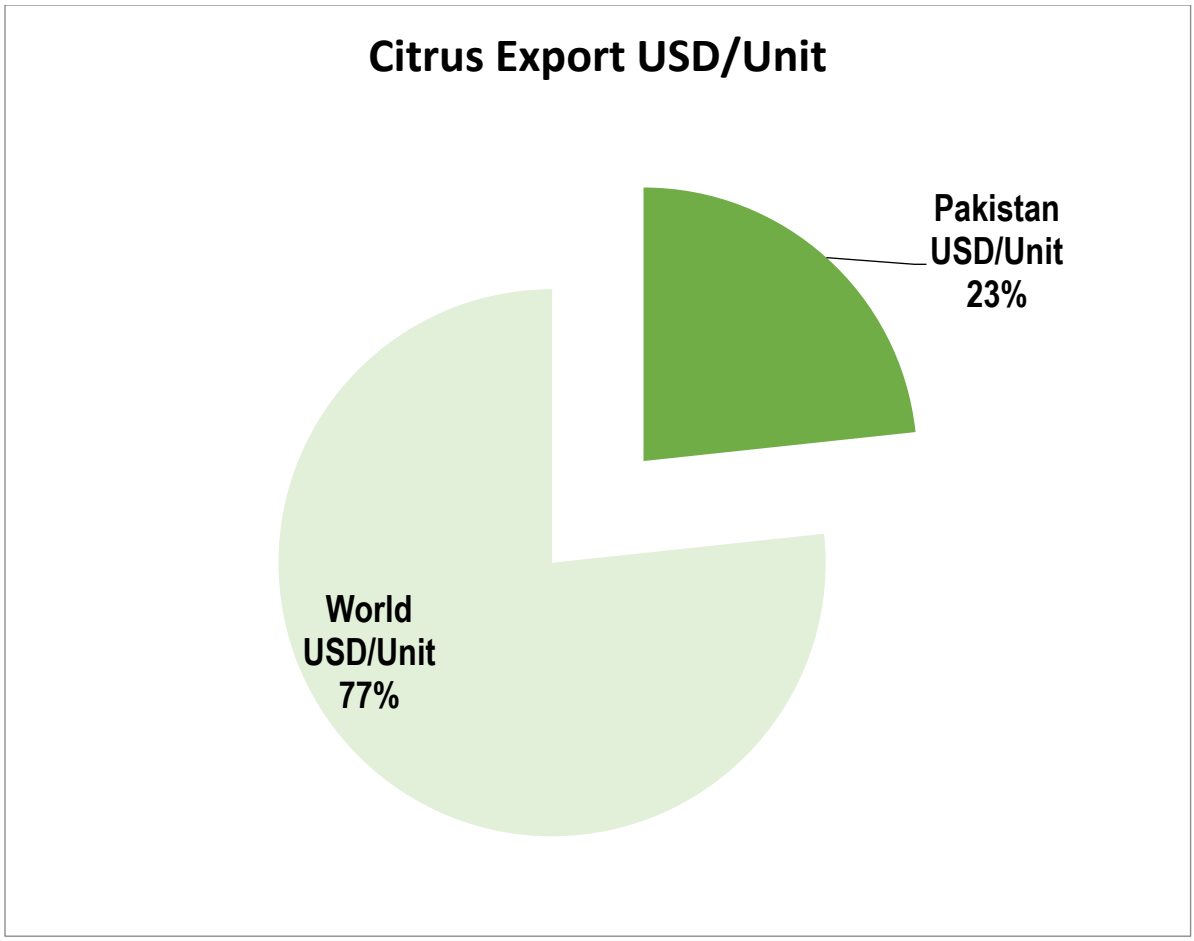


Figure 24: Citrus Exports
Source: Trade Map

As a result, a big share of export quality citrus fruit rejected annually due to the presence of citrus related disease on fruits. There is an urgent need to control the disease to a reasonable level and be able to sort various types of Citruses. The challenges and issues faced by the Citrus production in Faisalabad division are listed below.

ix. CHALLENGES AND ISSUES

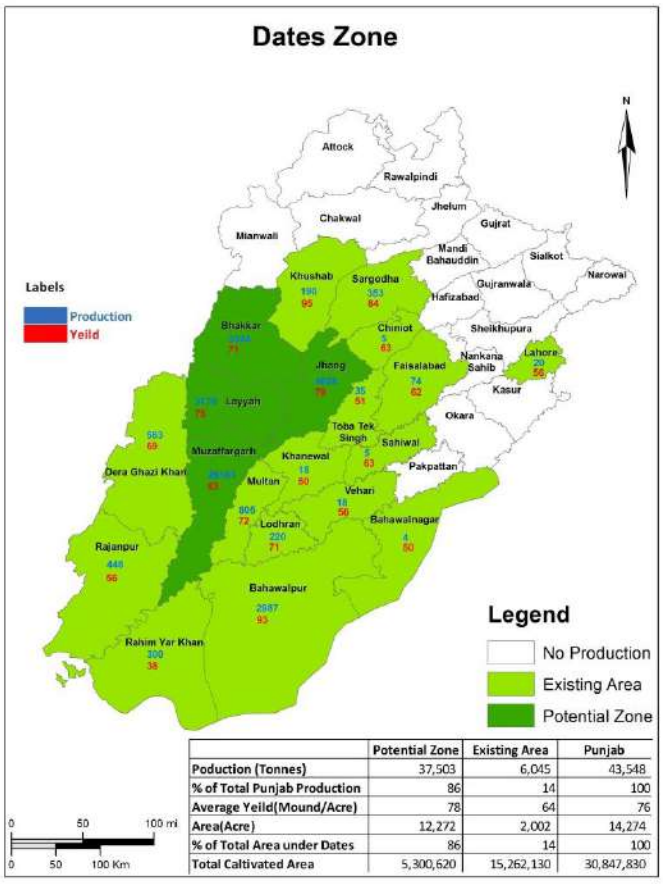
Inputs	Production	Harvest	Markets & Logistics
Unapproved/ uncertified varieties Lack of institutional support to provide a database and inventorying of certified, disease-free seed plants. Unreliable supply of certified plants. Lack of registered nurseries Poor nursery management practices Inadequate supply of plants required for new zones. Inefficient Irrigation systems	Fail to meet Demand annually because of limited capacity. Old outdated orchard management practices No disease-free zones were identified for new plantation No standardized curriculum for orchard management Reduced shelf life of fresh fruits Food safety issues Spread of diseases Low Price Lack of extension services and technical assistant Poor pest/disease management Imbalance uses of Nutrition Intercropping	Post-Harvest Losses up to 20% Quality assurance mechanisms and standardized The existing capacity of frozen juice is low Increase the life of the product to improve exportability Lack of modern technology Low and inadequate quality of existing storage facilities Low automation Labor expenses	Poor marketing infrastructure Lack of marketing campaign for local consumption Marketing/trading Citrus under one brand from Pakistan as a premium product Lack of market research/ market identification Poor access to the high-end market Lack of presence at international exhibitions/ trade shows Inadequate and scarcity of existing facilities for Grading, Polishing, and sizing for local market demands.

x. RECOMMENDATIONS

Inputs	Farms Management & Zoning	Marketing & Access to Finance
CRI to develop new seed varieties DNA & all other required testing are for mother plant and scion varieties Identify protocol for export of citrus to the various markets. Upgradation of CRI and capacity building of their staff Linkages with academia and international researchers for R&D Survey of nurseries to identify capacity to produce/ multiply disease-free plants Timely availability of water and other inputs	Farm Mechanization Develop Standardized Manual on Citrus Orchard Management practices Declare Citrus emergency to enforce the adoption of standardized manual practices Develop 75,000 acres (through EMFP) on improved orchard management practices to target the export market Awareness and training of farmers on standardized orchard management and improved irrigation practices Provision of extension services	Developing state-of-the-art Cold-Storage Improved local markets, & international linkages Provide an incentive for setting up new industries Develop local manufacturing industry to manufacture Grading/Sorting/Packing lines Develop a concerted media campaign for increasing the consumption of citrus products Develop a zoning-based state-of-the-art citrus trading market Identification of demand in the international and local market On-going varietal development based on market research

1.8.5. DATE PALM VALUE CHAIN

As per the statistics, the global production of dates is 8.2 million tons while Pakistan stands at 6th position among the largest dates-producing countries in the world. In Pakistan, dates are grown at 98 thousand ha, with 541 thousand tons of production and an average yield of 5.5 tons per ha. Globally, 1.25 million tons of dates worth price US$1.48 billion were exported during 2017. However, the top dates producing countries are Egypt, Iran, Algeria, and Saudi Arabia, while Iran, UAE, Pakistan, and Iraq are the top date exporting countries. On the other hand, India, UAE, Morocco, and France are leading dates importing countries both in quantity and value terms. The export of dates from Pakistan reached US$108 million in 2017. Moreover, Pakistani dates in international markets fetch only 60% of the world average export price indicating issues in its value chain resulting in poor quality dates. Expansion in export along with declining production has already reduced the per capita consumption of dates in Pakistan by about 42%.



	Potential Zone	Existing Area	Punjab
Poduction (Tonnes)	37,503	6,045	43,548
% of Total Punjab Production	86	14	100
Average Yeild(Mound/Acre)	78	64	76
Area(Acre)	12,272	2,002	14,274
% of Total Area under Dates	86	14	100
Total Caltivated Area	5,300,620	15,262,130	30,847,830

Parameter	World	Pakistan	Share (%)
Area (000 ha)	1330	98.0	7.37
Production (000 tonne)	8166	524.0	6.42
Value of production (Million US$)	9815	392.1	3.99
Yield (tonne/ha)	6.14	5.3	87.07
Farm gate price (US$/tonne)	1202	748	62.25
Quantity of international trade (000 tonne)	1253	175.1	13.98
Value of international trade (Million US$)	1477	107.5	7.28
Export quantity as % of production	15%	33%	-
Export value as % of production value	15%	27%	-
Average export prices (US$/tonne)	1042	629	60.33

Figure 25: Global Perspective 2017
Source: FAOSTAT, Production, Trade, Crops, and Livestock

Countries	Area (ha)	Production (tonnes)	Yield (t/ha)
Egypt	49.5	1590.4	32.1
Iran (Islamic Republic of)	169.8	1185.2	7.0
Algeria	167.7	1058.6	6.3
Saudi Arabia	108.1	754.8	7.0
Iraq	365.9	618.8	1.7
Pakistan	98.0	524.0	5.3
United Arab Emirates	65.0	475.3	7.3
Sudan	37.1	439.4	11.8
Oman	24.6	360.9	14.7
Tunisia	64.4	260.0	4.0

Figure 26: Top Ten Dates Producing Countries of The World, 2017
Source: FAOSTAT, Production, Crops

In terms of yield, the productivity of date palms in the Faisalabad division can be influenced by factors such as the quality of seed, the use of fertilizers and other inputs, and the application of modern agricultural practices. The average yield of dates in the region can range from 10 to 20 tons per hectare, depending on the specific growing conditions and the type of date variety being grown.

It is important to note that date production in the Faisalabad division can be impacted by various challenges, such as disease and pest pressures, water scarcity, and labor shortage. Effective measures to address these challenges, such as investing in research and development, encouraging the adoption of modern agricultural practices, and promoting the use of integrated pest management techniques, can help to improve the performance and productivity of the date industry in the region.

Overall, the date production in the Faisalabad division is an important part of the local and national economy, and it is important to continue to monitor and understand the various factors that impact its cultivation and productivity in order to ensure its continued success.

According to the last Planning Commission of Pakistan, Ministry of Planning, Development & Special Initiatives report, global production of dates was 8.2 million tonnes from more than 1.3 million ha with an average yield of 6.1 tonnes per ha. Pakistan stands at 6th position among the largest dates producing countries in the world.

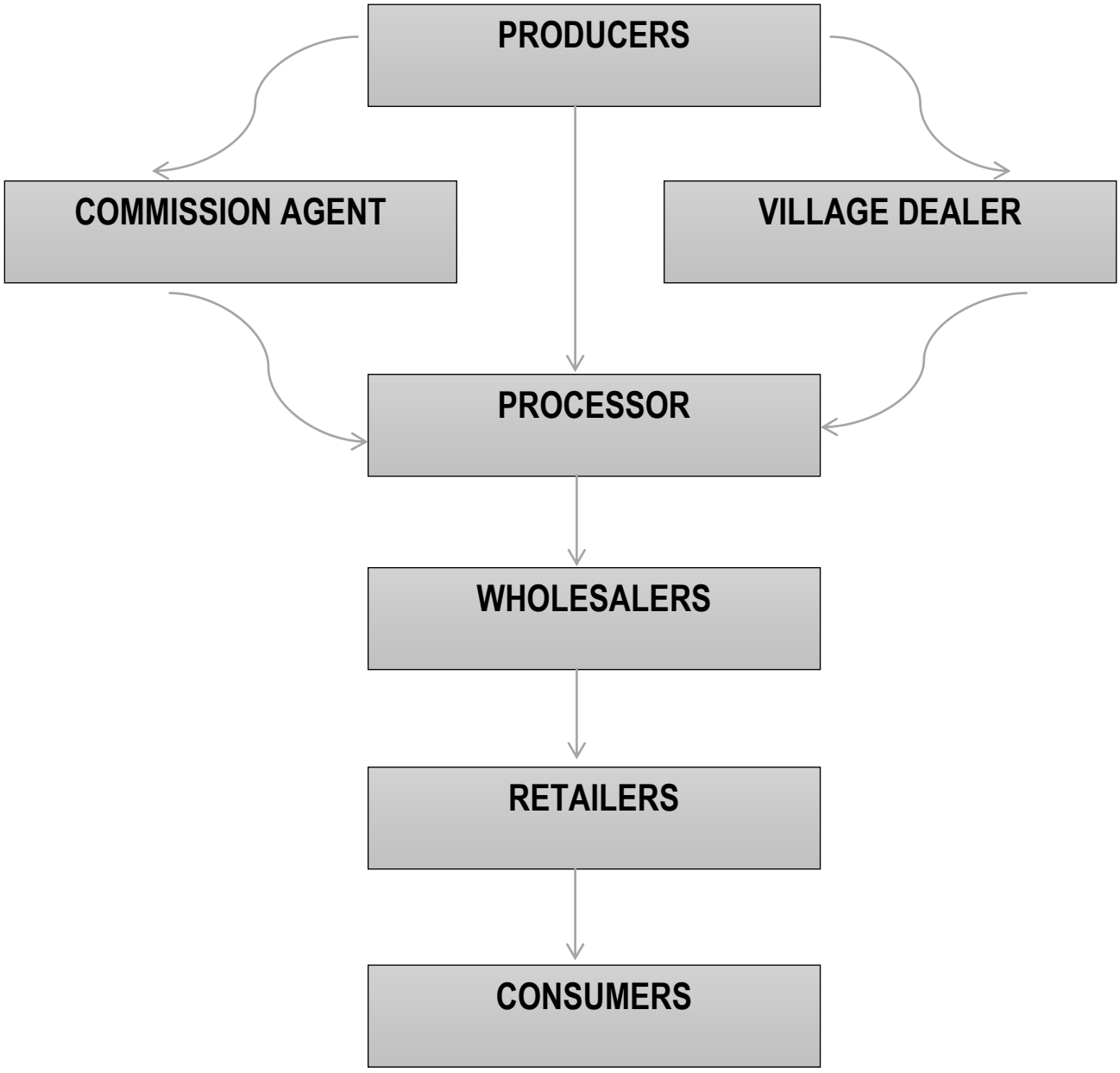
xi. CHALLENGES AND ISSUES

Inputs	Production	Harvest	Markets and Logistics
High Yield Germplasm is required to replenish orchards Lack of knowledge and training programs. Low-Quality Cultivars. Lack of initial land and orchard preparation. Lack of institutional support and research to provide high-quality seed plants. Non-availability of quality fertilizers and micronutrients in the local input market.	Only a few varieties available in farmers' orchards Shortage of skilled labor Underdeveloped Date industry Monsoon rains and low temperature during the ripening of dates fruit Irregular rainfall and expensive Bunch cover Lack of Management Services Poor Farm Management. Non-availability of tissue-cultured date palms of local elite cultivars is another hindrance to dates production enhancement as farmers are using low-quality suckers.	Post-harvest losses are high. Poor handling of fruit during harvesting. Manual harvesting practice. Fruit is usually harvested at an early stage to avoid monsoon rains. Low and inadequate quality of storage facilities. No facilitated warehouses are present. Handling the crop after harvest is lacking the experience.	Secrete auction and biding for dates. Ups and downs in the market and effectively dealing with delaying payment tactics played by the commission agent. Limited knowledge of farmers about candidate markets of different quality of produce The dates farmers have little knowledge about the grading of the produce; and, they also possess less labor for professional handling.

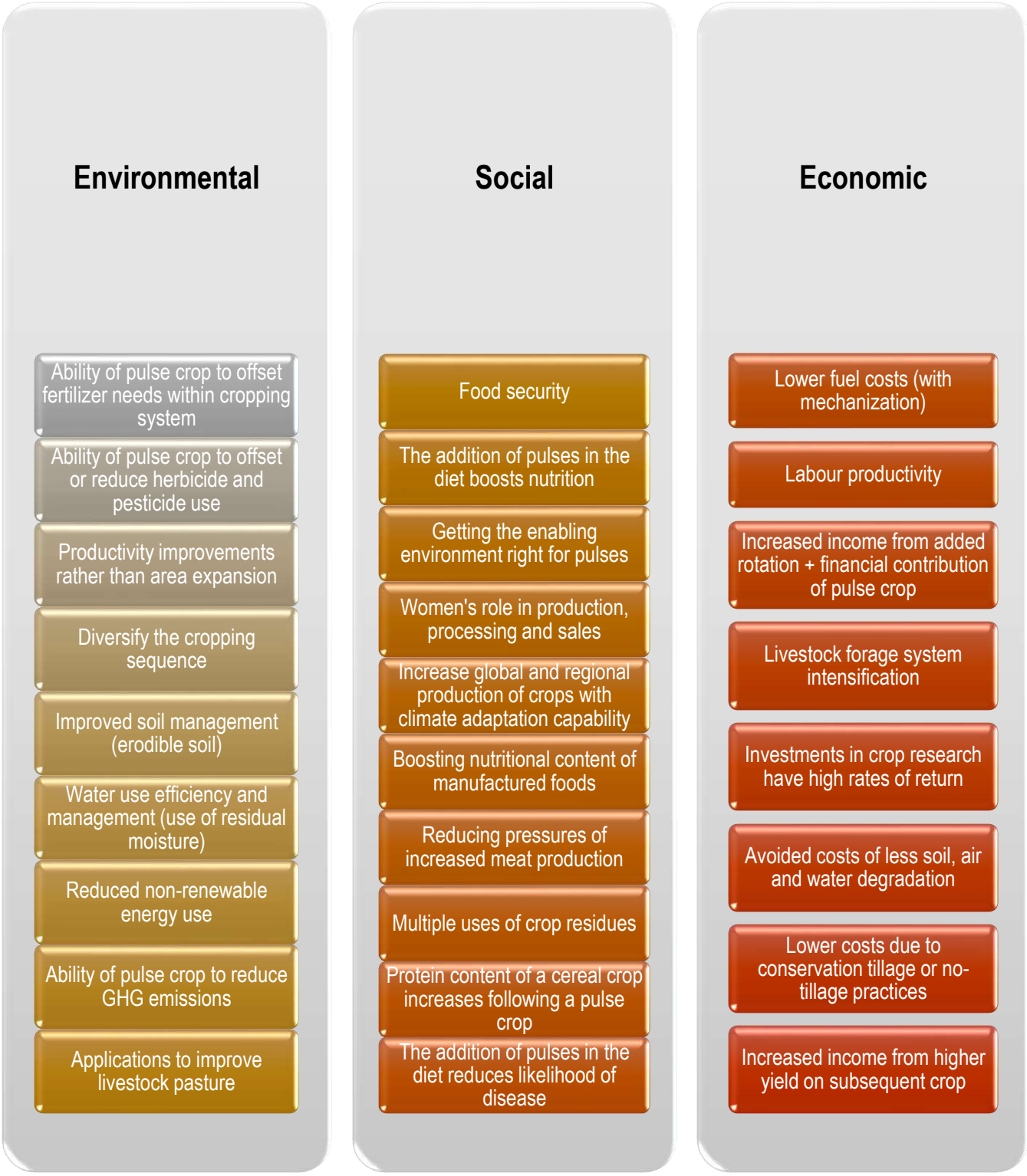
xii. RECOMMENDATIONS

Inputs	Farms Management and zoning	Marketing & Access to Finance
Linkages with academia and agricultural researchers for R&D. Proper orchards layout for high yield production. Initial Testing for water and soil quality. Availability of best quality inputs (fertilizers, herbicides) No formal Date grower association.	Capacity building and mechanized harvesting. Awareness and training of farmers on standardized farming and management. Improved irrigation practices. Availability of skilled and trained labor &Farm Mechanization Availability of cheap and efferent Pesticides	Agriculture literacy is needed to be enhanced for good date palm varieties and food security. Better Mode of transportation from farm gates to markets. Cold chains (cold storage, refrigerated containers (transportation) proper cold storage at markets). Easy procedures for shipment of dates to export globally.

1.8.6. PULSES VALUE CHAIN



xiii. PULSES BENEFITS – FINANCIAL, ENVIRONMENTAL, SOCIAL



Source: Adapted from Kissinger (2016)

1.8.7. CHICKPEA/GRAM

Pulses are the most important source of vegetable protein in Pakistan. They are cultivated on 5% of the total cropped area. Their use ranges from baby food to delicacies of the rich and the poor. Because of the population growth, demand for pulses is increasing day by day. There is a need to develop varieties with higher yield potential that respond to improved management practices to meet the increasing demand for pulses.

The value chain of gram or chickpea in the Faisalabad division of Pakistan involves multiple actors and stages, from production to consumption. A value chain analysis can help to identify the key actors and processes involved in the production and marketing of this crop, and can provide insights into areas where improvements can be made to increase the competitiveness and efficiency of the value chain.

The main actors in the chickpea value chain in the Faisalabad division include farmers, processors, wholesalers, retailers, and consumers. The production stage involves growing the crop, which may include activities such as seed selection, planting, irrigation, and pest management. After harvest, the crop may undergo processing and packaging, and may then be transported to wholesalers, who sell it to retailers. Finally, consumers purchase and consume the chickpea.

Throughout the value chain, there may be opportunities to improve the efficiency and competitiveness of the chickpea industry in the Faisalabad division. This could include investing in research and development to improve seed varieties, promoting the use of modern agricultural practices, and improving the quality of processing and packaging facilities. Additionally,

addressing challenges such as disease and pest pressures, water scarcity, and labor shortage can help to ensure a steady and reliable supply of chickpeas in the region.

In order to improve the competitiveness and efficiency of the chickpea value chain in the Faisalabad division, it is important to engage with all actors in the value chain, including farmers, processors, wholesalers, and retailers. This may involve working with government agencies and private sector organizations to support research and development efforts, provide training and technical assistance, and promote the use of modern agricultural practices. By taking a collaborative and holistic approach, it is possible to improve the performance and competitiveness of the chickpea industry in the Faisalabad division, and to ensure its continued success.

Major importance to chickpea improvement was attributed because it contributes 70-80% to the area and production of the total pulse. The Thal desert which cannot support/sustain major cash crops due to low fertility and lack of artificial irrigation is well known as the home of chickpea. This is because chickpeas can perform well under conditions of moisture stress in marginal soils. The drought tolerance in this crop is an extremely desirable attribute for moisture deficient areas of the country. The medium fertility, moderate moisture levels, sandy loam soils, and moderate winters provide optimum conditions for chickpea cultivation. The visits reveal swear fluctuation highlighting the problem of instability, which may be attributed to 3 major constraints. Drought or moisture stress and wilt are the twin problems that occur together. The third major constraint to chickpea production is Ascochyta blight.

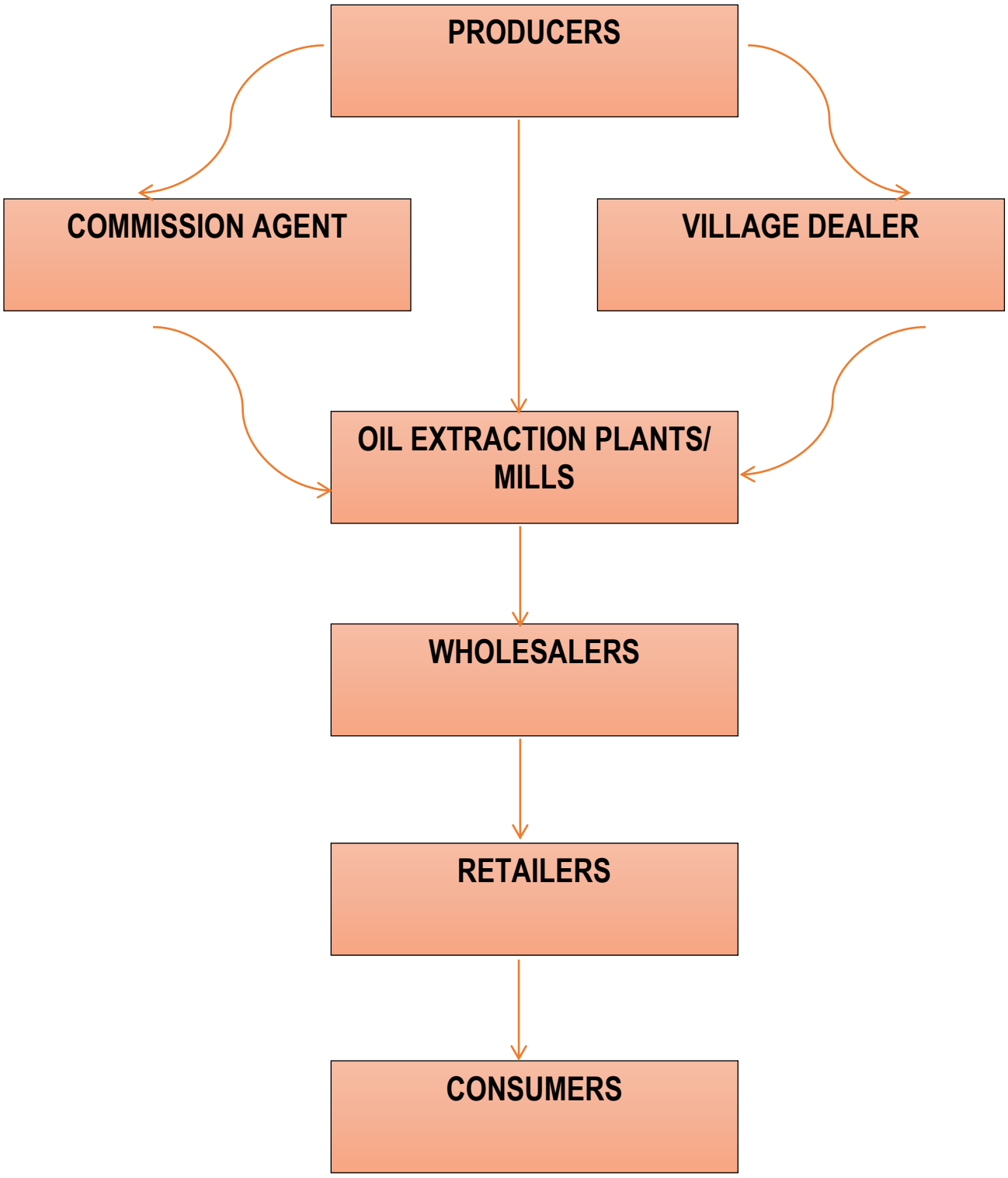
There are two main types of chickpea, distinguished by seed size, shape, and color. The first relatively small seeds are called desi and with a large seed called Kabuli. Desi chickpea is cultivated mainly in the Indo-Pakistan subcontinent. Chickpeas are used both for human consumption and animal feed in rural and urban areas.

Chickpea is grown in tropical, subtropical, and temperate regions. Kabuli type is grown in temperate regions while the desi type chickpea is grown in the semi-arid tropics. Gram covers a major portion of the rice area in the winter season and is a common Dubari crop of rice tract in Sindh. Khushab, Thal desert, Cholistan, and Bahawalpur are the main growing areas are in Punjab.

1.8.7. OILSEEDS VALUE CHAIN

Rapeseed and mustard are important species grown as oilseed crops in Pakistan. These species are a rich source of oil and contain 40-46% good quality oil. In addition, its meal has 38-40% protein which has a complete profile of amino acids including lysine, methionine, and cystine. The oil from canola quality rapeseed varieties is superior for human consumption and meal an excellent feed for animals and birds, especially poultry. Thus, the development of canola quality rapeseed will enhance the use of rapeseed oil for edible purposes and meals for animal and poultry feeding. Among oilseed crops, canola has considerably contributed to the local production of edible oil due to its high varietal potential and increase in area. However, there is a great potential to increase the area under the canola.

The export of oilseeds from the Faisalabad division to international markets can play a significant role in the local and national economy. The export of these products may be impacted by factors such as global market conditions, trade policies, and competition from other exporting countries. It is important to monitor the export performance of oilseeds in the Faisalabad division in order to understand the impact of these factors on the local and national economy.


PRODUCERS
COMMISSION AGENT
VILLAGE DEALER
OIL EXTRACTION PLANTS/ MILLS
WHOLESALERS
RETAILERS
CONSUMERS

1.8.8. DEVELOPMENT OF MODEL FARMS

The establishment of model farms is an important step in the development of agriculture, as it provides an opportunity to showcase best practices and demonstrate the benefits of adopting new technologies and techniques. By establishing model farms, agricultural researchers and extension workers can demonstrate the potential for increased yields and improved productivity, and encourage farmers to adopt these practices on their own land.

Model farms can serve as a hub for knowledge transfer, providing a platform for farmers to learn about the latest innovations in agriculture, including advances in seed technology, soil management, irrigation techniques, and agronomic practices. They can also provide a space for farmers to test new practices and technologies, and to receive hands-on training and support.

By promoting the use of best practices and innovative technologies, model farms can play a critical role in increasing agricultural productivity and yields, and improving the livelihoods of farmers in the region. This, in turn, can contribute to the development of the wider economy and help to achieve food security for local communities.

Additionally, model farms can also provide an important source of income for the local economy, by selling surplus crops and by attracting visitors who are interested in learning about innovative agricultural practices.

Overall, the establishment of model farms is a key strategy for improving the productivity and competitiveness of the agricultural sector, and for promoting sustainable and equitable economic growth in rural areas.

The Urban Unit provides several initiatives to develop agriculture model farms in the Faisalabad division. Some of these initiatives include:

- ***The establishment of a Model Agricultural Farm in the Faisalabad division. This farm will demonstrate modern farming techniques and technologies, and will provide a platform for farmers to gain hands-on experience on how to increase their yields.***
- ***The development of Agriculture Technology Park in the Faisalabad division. This park will demonstrate modern agricultural technology and provide a platform for farmers to gain access to the latest technologies.***
- ***The establishment of a network of agricultural extension offices in the Faisalabad region districts. These offices provide technical advice and support to farmers, and help them to increase their yields.***
- ***To launch several programs to promote integrated pest management in the Faisalabad division. These programs provide farmers with access to the latest pest management technology and help them to reduce pest damage and increase yields.***
- ***To launch a program to promote integrated crop management. This program provides farmers with access to the latest crop management technology and help them to increase their yields.***

These initiatives, coupled with other initiatives such as public-private partnerships and improved access to agricultural credit, will help to develop agriculture model farms in the Faisalabad division. These model farms will provide farmers with the knowledge and skills they need to increase their yields and improve their livelihoods. Finally, the model farm should be monitored and evaluated. This evaluation should include an assessment of the farm's economic performance, its environmental effects, and its impact on the local community. The findings of the evaluation should be used to adjust the model farm and to identify areas for further improvement.

1.9. KEY INTERVENTIONS

The urban unit recognizes that some important interventions need to be addressed on short, medium, and long-term project scales.

Crops	Phase	Interventions	Cost (Tentative) in Million Pkr
Lady Finger	Short-term	**Seed replacement program; through multiplication of pre-basic and basic quality seed developed by VRI by introducing private seed companies to reduce import bill**	214
		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop ladyfinger cluster	171
	Medium-term	**Organizing labor training programs with the help of VRI to ensure skill labor availability in the Crop Cluster**	150
		Establishment of market in the crop cluster with storage, packing and grading facilities to ensure quality	200
		Establishment of value-added production unit by incentivizing private sector	60
	Long-term	**Development of Certified Seed Varieties (Pre basic, basic and multiplication)**	200
Total			**995**
Sugarcane	**Short-term**	**Cost Sharing on Sugarcane Implements (Chisel Plough , Early hill up implement , Sugarcane Planter, Granular Pesticide Applicator).**	120
	Medium-term	**Showcasing of Good Agricultural Practices (GAP) on balanced use of fertilizer, Weedicide application, and Integrated Crop Management (ICM) by Public private partnership to establish demonstration plots.**	30
		Promotion of water saving technologies for sugarcane production e.g. planting on beds, pit planting etc. to curtail the growing menace of water logging.	300
		Promotion of Intercropping, September Planting and Chip Bud Technology [Strengthening of Bio-labs for development of Integrated Pest Management program (IPM)].	20
	Long-term	**Development of climate smart high yielding varieties to cope with the climate change effects within the region**	200

		Sugarcane value addition enhancement program with the help of research institutes	200
Total			**870**
Wheat	**Short-term**	**Provision of Subsidy within crop cluster on gypsum & green manuring to support farmers of wheat**	1117
		Provision of Subsidy within crop cluster on implements for wheat on cost sharing basis	900
		Provision of Subsidy within crop for Seed Replacement Program to ensure quality production	1300
		Provision of Subsidy within crop cluster on fertilizer and weedicides to support small farmers	1200
	Medium-term	**Development of Smart tools for mechanization especially for small farmers.**	1000
		Multiplication of pre-basic and basic quality seed developed by wheat research institute by introducing private seed companies to reduce import bill	700
	Long-term	**Climate Smart breeding program (Rebreeding, Hybridization, and innovative technologies for various zones: Rust and heat stress tolerant varieties, Spring Wheat, Durum Wheat, Triticale etc.).**	500
Total			**6,717**
Citrus	**Short-term**	**Conduct market survey to identify demand in international and local market for Kinnow and other varieties and identifying protocol for export of citrus to the various markets & conduct survey of registered nurseries. All nurseries to be given targets to produce 20 million plants & monitor them.**	200
		Incentivize and subsidize farmers for Integrated Orchard Management to minimize disease spread and crop damage	4000
	Medium-term	**Incentivizing private sector by credit through banks for the establishment of Citrus processing unit within the crop clusters**	320
		Incentivizing private sector by credit through banks for the establishment of Citrus juice processing unit within the crop clusters	200
		Incentivizing private sector by credit through banks for the establishment of Cold storage within the crop clusters	600

	Long-term	**Development of Certified Seed Varieties (Pre basic, basic and multiplication) according to the international market demand**	350
Total			**5,670**
Matter Peas	**Short-term**	**Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop peas cluster.**	**296**
		Seed replacement program; through multiplication of pre-basic and basic quality seed developed by VRI by introducing private seed companies to reduce import bill	**300**
	Medium-term	**Establishment of food processing units in peas processing (frozen peas) to meet the local need during scarcity period**	**180**
		Establishment of market in the crop cluster with storage, packing and grading facilities to ensure quality	**200**
	Long-term	**Development of Certified Seed (Pre basic, basic and multiplication) to the Farmer of peas.**	**300**
Total			**1,276**
Rapeseed and Canola	**Short-term**	**Provision of High-Quality seed; through multiplication of pre-basic and basic quality seed developed by Oilseed Research Institute by introducing private seed companies to reduce import bill**	**250**
		Introducing policy for the provision of Support price till market development.	**150**
		Organizing competitions for the appreciation of best growers on provincial and district level.	**150**
		Arrange seminars at district level in core oilseed districts to create awareness about best management practices/production technology for selected crops during Rabi and Kharif season.	**150**
		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop crop clusters.	**160**
	Medium-term	**Promote mechanization for oilseed crops in order to minimize post-harvest losses and get good yields.**	**533**
		Ensure Hybrid Seed Availability through National and Multinational Seed Companies.	**300**
		Incentivizing private sector by credit through banks for the establishment of Oil extraction units in clusters.	**600**
	Long-term	**Establishment of state-of-the-art oilseed market with storage, packing and grading facilities to ensure quality.**	**300**

		Address low yields of oilseed crops by enhancing production both vertically and horizontally.	**160**
Total			**2,753**
Dates	**Short-term**	**Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop crop clusters.**	**171**
		Establishment and promoting and registering the date palm nurseries	**210**
		Provision of Better Management Practices for raising productivity	**150**
	Medium-term	**Incentivize and subsidize farmers for Integrated Orchard Management to minimize disease spread and crop damage**	**75**
		Establishment of dates market in dates cluster with storage, packing and grading facilities to ensure quality.	**250**
	Long-term	**Introducing the Solar Tunnel Dates Drying to enhance value addition and introducing dates export**	**150**
		Strengthen research institutes for the Promotion of R & D activities	**120**
		Improving Value Addition by Introducing Packhouses for Export Market	**170**
		Development of Certified Seed (Pre basic, basic and multiplication)	**200**
		Upgradation of Orchards with High Density Plantation	**250**
Total			**1,746**
Moong	**Short-term**	**Improve awareness on areas to promote moong cultivation**	**60**
		Incentivize and subsidize farmers for Moong soil fertility and crop management	**120**
		Improved knowledge on crop management technologies and fertility requirements	
		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop crop clusters.	**150**
		Economic importance of pests, diseases and weeds identified	
		Incentivize and subsidize farmers for Management of pests, diseases and weeds identified	
	Medium-term	**Moong harvesting, post-harvest management, value addition and marketing**	**200**
	Long-term	**Development of Certified Seed (Pre basic, basic and multiplication) to the Farmer of peas.**	**140**
Total			**670**
Gram	**Short-term**	**Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop gram cluster**	**171**

		Provision of Sprinkle Irrigation to improve water efficiency within the crop cluster	**780**
	Medium-term	**Provision of High-Quality seed; through multiplication of pre-basic and basic quality seed developed by Research Institute by introducing private seed companies to reduce import bill**	**110**
		Improving Value Addition by Introducing Packhouses for Export Market	**170**
		Organizing labor training programs with the help of CRI to ensure skill labor availability in the Crop Cluster	**130**
		Establishment of gram market in gram cluster with storage, packing and grading facilities to ensure quality.	**210**
	Long-term	**Provision of High-Quality seed; through multiplication of pre-basic and basic quality seed developed by Research Institute by introducing private seed companies to reduce import bill**	**150**
Total			**1,721**
Water Melon	**Short-term**	**Good Agricultural Practices (GAP) and Food Safety Management System (FSMS)**	**170**
	Medium-term	**Provision of High-Quality seed; through multiplication of pre-basic and basic quality seed developed by Research Institute by introducing private seed companies to reduce import bill**	**180**
		Introducing Watermelon climate smart agronomic practices with the help of HRI	**110**
		Integrated soil and water management practices for Watermelon production	
		Incentivize and subsidize farmers for Watermelon harvesting and post- harvest management	**130**
		Incentivizing private sector by credit through banks for to introduce Watermelon value addition	**200**
	Long-term	**Incentivize and subsidize farmers for Mechanization of watermelon production activities**	**250**
		Development of Certified Seed (Pre basic, basic and multiplication) to the Farmer of peas.	**200**
Total			**1,240**
Guava	**Short-term**	**Incentivize and subsidize farmers for Development of best agronomic practices**	**140**

		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop gram cluster	**150**
	Medium-term	**Capacity building of the institutes to Improve access to extension & technology**	**180**
		Experimenting with GAP as a strategy to open Guava markets	**190**
	Long-term	**Development of Certified Seed (Pre basic, basic and multiplication)**	**170**
Total			**830**
Bitter & Apple gourd	**Short-term**	**Local seed varieties replacement program; through multiplication of pre-basic and basic quality seed developed by Research Institute by introducing private seed companies to reduce import bill**	**265**
		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop Bitter gourd cluster	**131**
	Medium-term	**Organizing labor training programs with the help of VRI to ensure skill labor availability in the Crop Cluster**	**120**
		Establishment of markets of Bitter gourd cluster with storage, packing and grading facilities to ensure quality.	**100**
		Incentivizing private sector by credit through banks for to introduce Establishment of Value-Added products	**35**
	Long-term	**Development of Certified Seed Varieties (Pre basic, basic and multiplication)**	**130**
Total			**781**
Garlic	**Short-term**	**Local seed varieties replacement program; through multiplication of pre-basic and basic quality seed developed by Research Institute by introducing private seed companies to reduce import bill**	**141**
		Provision of inputs (Fertilizer, Pesticides and Implements) on subsidy to develop garlic cluster.	**130**
	Medium-term	**Organizing labor training programs with the help of VRI to ensure skill labor availability in the Crop Cluster**	**90**

		Establishment of garlic market in garlic cluster with storage, packing and grading facilities to ensure quality.	**110**
		Incentivizing private sector by credit through banks for Establishment of Garlic powder and paste production unit	**70**
		Strengthen and capacity building programs for the provision of specialized extension services.	**80**
	Long-term	**Development of Certified Seed (Pre basic, basic and multiplication) to the Farmer of Garlic.**	**245**
		Incentivize and subsidize farmers for Mechanization of Garlic production activities	**220**
Total			**1,086**
GRAND TOTAL			**26,355**
Improve Water Efficiency	**Short-term**	Climate Smart Water Management and Information Services	**304**
		•Development of a Water Accounting System	
		•Development of an Evapotranspiration-based Water Management System	
		•Development of an Early Warning System	
		•Provision of Information and Data to Facilitate Climate Change Adaptation	
		Building on-Farm Resilience to Climate Change	**348**
		•Development of practices for climate change resilient	
		•Training of extension workers and farmer facilitators	
		Establishment of Technology Transfer Centers (TTCs) in Sargodha Division for the demonstration to enhance water use efficiency through;	**655**
		•Farm layout planning/ designing, precision / LASER land leveling and water budgeting & accounting.	
		•Provision of rapid soil testing kits to the farmers at TTCs for application of balanced fertilizer.	

		•Fixation of pipe nakkas according to soil type and water flow for channelized stream flows.	
		•Installation of flow measurement devices for open channels and tubewells for measuring the discharge of water for water accounting.	
		•Installation of soil moisture monitoring gadgets.	
		•Application of Alternate Wetting & Drying (AWD) and Direct Seeding Rice (DSR) water saving techniques in rice fields to increase the water productivity.	
		Support farmers for installation of tunnels for off-season vegetable production.	**210**
		Provision of 400 LASER land levelers to the farmers/ service providers for strengthening LASER land leveling services in the private sector.	**400**
	Medium-term	Construction of on-farm water storage ponds in irrigated areas for storing excess canal/ rainwater for supplemental irrigation.	**6,825**
		Install solar systems for operating high efficiency irrigation systems.	**630**
	Long-term	Improvement of unimproved & additional lining of watercpourse improvement	**6,000**
		Promote high efficiency irrigation systems on Drip and Sprinkle Irrigation System on fruit and vegetables farms.	**871**
		Deliver soil moisture to the farmers/ service providers.	
TOTAL			**16,243**
COMMON STRUCTURAL PROJECTS	**Medium-term**	Strengthen and capacity building programs for the Provision of specialized extension services for vegetable crops.	300
		Strengthen and capacity building programs for the Provision of specialized extension services for fruits.	300
		Ease of financial access and insurance services to farmers.	300
		Up gradation and establishment of agriculture markets with storage, packing and grading facilities to ensure quality..	500
		Incentivizing private sector by credit through banks for Establishment of feed mills.	300
		Incentivize and subsidize farmers for Integrated Pest diagnosed, warning, and control management for all crops	200
		Set up of support system for the farmers in case of crop failure and price fluctuation for vegetables and fruit crops.	500

	Long-term	Incentivizing private sector by credit through banks for Establishment of state-of-the-art warehouse and grain silos.	300
		Promoting research for enhancement of mash and lentil production to reduce pulse import bill	51
		Improving an organizations overall performance and efficiency by improving the members (individuals and groups) performances, commitment, and flexibility. (HR)	.
TOTAL			**2,751**
GRAND TOTAL			**45,349**