DIRECTORATE GENERAL OF SCIENCE AND TECHNOLOGY (DOST)
GOVERNMENT OF KHYBER PAKHTUNKHWA

KHYBER PAKHTUNKHWA
SCIENCE AGENDA

DEPARTMENT OF SCIENCE & TECHNOLOGY AND INFORMATION TECHNOLOGY
GOVERNMENT OF KHYBER PAKHTUNKHWA

FRUITS AND VEGETABLES

Ideal climate of KP supports a diversity of fruit and vegetable produce that ensures livelihoods, food security, and superior export potential

TASKFORCE REPORT

Fruits & Vegetables in Khyber Pakhtunkhwa: Sectoral analysis, local Challenges and Strategic Insights/Recommendations

2023

FOREWORD

In alignment with the Science Agenda for Khyber Pakhtunkhwa, the Directorate General of Science & Technology initiated a landmark effort to identify and advance priority areas where science, technology, and innovation can meaningfully contribute to the province's socio-economic development. We present to you the sectoral reports in kay natural resource areas that are ideally unique to Khyber Pakhtunkhwa and have been identified for R&D investments.

Each of these sectoral reports marks an important milestone in advancing scientific understanding and strategic development within Khyber Pakhtunkhwa's natural resource sectors, through focused inquiry and collaborative expertise. These reports, developed by thematic Task Forces constituted under the Directorate General of Science & Technology, are foundational efforts under the broader Science Agenda for Khyber Pakhtunkhwa — a transformative initiative that seeks to reposition the province as a regional leader in science, technology, and innovation as we explore the potential of Khyber Pakhtunkhwa's rich natural resource landscape.

Under the Science Agenda, we hold a bold and pragmatic approach: to build on the province's existing strengths while investing in the future. The identification of eight natural resource areas — from gemstones and herbs to fisheries, fruits and vegetables, bees and honey, micro-hydro power, archaeology, and the urban environment — presents a unique opportunity for science-led value addition and sustainable economic growth. Each thematic area represents not just a resource, but a vibrant ecosystem of challenges and opportunities, waiting to be enhanced through strategic interventions in research, development, and innovation.

These reports are the outcome of months of rigorous consultation, deep research, and collaborative ideation by multidisciplinary experts drawn from academia, industry, public sector, and civil society. The Task Forces were entrusted with the mission to map the current landscape, articulate key challenges, and recommend high-impact R&D pathways that can guide smart investment in the sector. This body of work now forms a scientific and strategic blueprint for stakeholders across sectors to drive meaningful change.

This initiative is aligned with our core vision to move Khyber Pakhtunkhwa from being a consumer of technologies to a creator of solutions — driven by our local talent, informed by global best practices, and anchored in our unique natural endowments. Through this endeavor, we reaffirm our commitment to building a culture of science that is inclusive, collaborative, and forward-looking.

I extend my deepest appreciation to all members of the Task Forces, as well as the wider science and innovation ecosystem that supported this effort. We look forward to translating the insights from these reports into tangible programs, R&D investments, and partnerships that uplift livelihoods, enhance competitiveness, and leave a lasting impact on the province's development trajectory.

Sajid Hussain Shah

Director General
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Government of Khyber Pakhtunkhwa

ACKNOWLEDGMENT

This policy report has been developed by the Directorate General of Science & Technology, Government of Khyber Pakhtunkhwa, as part of the Annual Development Program initiative focused on strategic natural resource development.

The report is the outcome of a time-bound effort by a dedicated Task Force constituted for this thematic area, comprising local experts from diverse institutional backgrounds including academia, government, industry, and the development sector. The Task Force worked collaboratively through multiple rounds of consultations to undertake a deep-dive analysis, identify context-specific challenges, and offer actionable insights to guide future scientific, technological, and policy interventions.

The findings of this report will also inform subsequent project components, including the design of targeted grant opportunities.

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FRUITS & VEGETABLES SECTOR IN KHYBER PAKHTUNKHWA

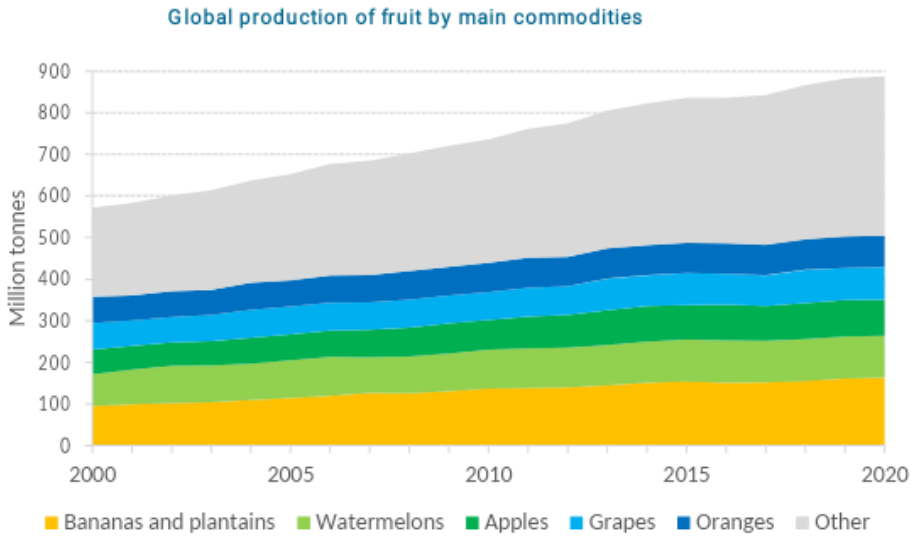
Background

In today's world, people are very conscious of their diet and eating habits. A busy lifestyle and a stressful work culture have increased the consumption of fruits and vegetables. Consequently, the sector is flourishing and opening new prospects for employment and research, thereby introducing a new dimension to the agriculture sector worldwide. Horticulture is now considered a separate industry. This has generated new income opportunities for farmers and others working in the allied sectors of this industry. The processing, transportation, distribution, and packing sectors associated with horticulture have also greatly benefited.

Global horticulture production in 2021-22 is estimated to be 341.63 million tons (mt) an increase of about 7.03 mt (rise 2.10 %) over 2020-21, according to the Ministry of Agriculture and National Food Security.

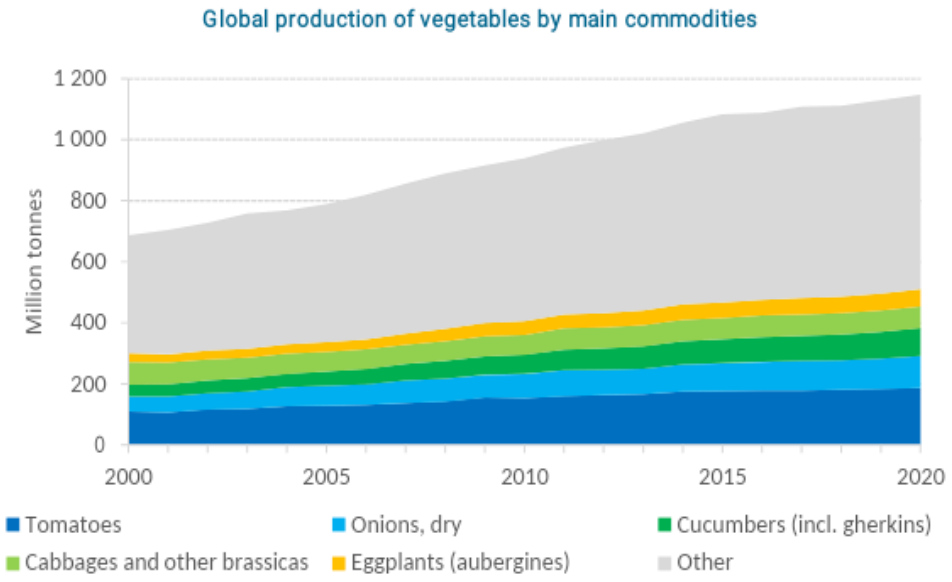
World fruit production went up 55 per cent between 2000 and 2020, to 887 million tons, which represents an increase of 315 million tons. Five fruit species accounted for 57 per cent of the total production in 2020, down from 63 percent in 2000: bananas and plantains (18 percent), watermelons (11 per cent), apples (10 percent), oranges and grapes (9 percent each). The share of bananas and plantains in the global total slightly increased since 2000, while that of the other main fruit species declined. India was the top producer of bananas and plantains in 2020 and accounted for just under 20 percent of the global production; China was the top producer of watermelons (59 percent of the world total), apples (47 percent) and grapes (19 percent); and with 22 percent of the world production, Brazil was the top producer of oranges.
Pakistan is identified as part of the next eleven group which has the highest potential of becoming one the largest economies of the world in 21st century. That the increase demand for food as well changes in dietary preference for safe and nutritious foods are inevitable in the coming years. The country domestic demand for fruits and vegetables in 2038 is projected to be about fifty million ton against a production of about fifteen million ton as of 2017 (ADB). Pakistan is divided in to ten agro-ecological zones based on physiography, climate, and land use and water availability. The country produced 6.6-million-ton vegetables and 5.89-million-ton fruits in 2001 which increased to 9.72-million-ton vegetables and 5.89-million-ton fruits in 2015. The yield of fruits and vegetables remained low due to various reasons.

Per capita consumption of fruits was 29 kg in Pakistan compared to 95 kg in Europe and 105 kg in USA. Per capita consumption of vegetable in Pakistan was 26 kg compared to 115 kg in Europe and 114 kg in USA in the same year.



Source: FAO. 2021. Production: Crops and livestock products. In: FAO. Rome. Cited March 2022.

The world's vegetable production increased significantly between 2000 and 2020, by 65 percent, or 446 million tons, totaling 1128 million tons. The five main vegetable species accounted for 42–45 percent of the total vegetable production during the period: tomatoes (16 percent in 2020), onions (9 percent), cucumbers (8 percent), cabbages (6 percent) and eggplants (5 percent). The share of onions, cucumbers and eggplants increased, while that of cabbages decreased by 50% and that of tomatoes remained stable. In 2020, China was the top producer of tomatoes (35 percent of the global production), cucumbers (80 percent), cabbages (48 percent) and eggplants (65 percent); India was the top producer of onions, contributing 26 percent of the global onion production.



Source: FAO. 2021. Production: Crops and livestock products. In: FAO. Rome. Cited March 2022.

FRUITS AND VEGETABLES SECTOR IN PAKISTAN

Horticulture in Pakistan has emerged as an important sector contributing to the national agricultural GDP with a 12% share during the last decade and produces several horticultural products to fulfil the domestic demand of fruits and vegetables for an ever-increasing population. The demand for fruits and vegetables is continuously increasing in local and export markets. Global horticulture exports reached $124 billion, and Pakistan marginally contributed with a worth of $0.24 billion, which is far less than a one percent share in world exports (FAO, Agriculture report, 2018).

The performance of Agriculture during 2018-19 remained subdued. It grew by only 0.85 percent against the target of 3.8 percent. The underperformance of the agriculture sector was due to a reduction in the area of cultivation, lower water availability and a drop in fertiliser off-take. (Pakistan Economic Survey 2018-19)

GDP growth has been slower than needed to provide for the level of jobs required for a young and growing population. Inadequacy in the private sector environment, public sector management, and implementation capacity continues to hamper service delivery performance. Thus, human development indicators continued to lag and resulted in low growth of the agriculture sector, inadequate rural infrastructure and connectivity to markets, weak governance and institutions, and limited access to finance.

AREA AND PRODUCTION OF HORTICULTURE COMMODITIES- PAKISTAN

Horticulture has great potential because of the huge area available for horticultural plantations. Pakistan's climate is most suitable for the cultivation of indigenous and exotic fruits and vegetables.

Some of the major fruits and vegetables produced are Mangoes, Oranges, Apples, Peaches, onions, Tomatoes, Carrots and Watermelons, among others. Onions, Tomatoes, and Carrots together make up around 58% of the gross vegetable production in Pakistan, while Mangoes and Oranges contribute about 45% of the gross fruit production in Pakistan. Production of Peach, Apples, Dates, Grapes, Persimmon, and Pomegranate, reflecting the strong domestic market demand for horticulture crops. Citrus fruits, primarily the mandarin variety Kinnow, are the largest fruit crop group by volume and are a major export revenue earner. Pakistan is the fifth-largest producer of Dates. Mango production is in millions of tons, but only a small fraction of the same is exported annually. A large number of indigenous fruits and vegetable commodities are produced in the country, and there is scope for the cultivation of exotic crops as well.

PROVINCE-WISE PRODUCTION SHARE OF MAJOR VEGETABLES

Potatoes have the maximum production of 3392.5 thousand tons, of which more than 95% comes from Punjab. Next to potatoes are onions with a total production of 1817.4 thousand tons, of which 41% come from Sindh, 29% from Baluchistan and 20% from Punjab. Tomato production stands at third position, with Baluchistan being the main producing area contributing 38%, followed by Sindh, KP and Punjab with 25%, 23% and 15% share in total production. The agro-ecological suitability of the southern zone of the country to produce chillies has resulted in an increased share of Sindh province to 59.4% of the total production. Punjab contributes 21.1% and Baluchistan 18.3%, whereas KP contributes only 1.2% of the total production of chillies. Punjab has the highest share (72%) in the production of turnip, followed by Khyber Pakhtunkhwa, which shares more than 15%. Punjab is the main producing area of carrots, contributing more than 68% of total production, followed by Baluchistan (23%). Out of the total production of cauliflower, Punjab contributes more than 68%, followed by Baluchistan (17%). Punjab, Khyber Pakhtunkhwa and Baluchistan account for 71%, 13% and more than 11% respectively of the production of peas in the country. Punjab contributes more than 57% of the total production of okra, followed by Baluchistan (16%), Khyber Pakhtunkhwa (14%) and Sindh with more than 23%. More than 75% of tinda gourd production comes from Punjab.

Vegetables	Punjab production share %	Sindh production share %	KP production share%	Baluchistan production share %

Potato	95.4	0.1	3.5	1.0
Onion	19.9	41.0	10.1	29.0
Chilies	21.1	59.4	1.2	18.3
Tomato	15.0	24.5	22.5	38.0
Turnip	71.5	6.7	15.4	6.4
Okra	57.3	13.3	13.9	15.5
Carrot	68.4	5.8	3.3	22.5
Cauliflower	68.2	7.5	6.9	17.4
Peas	71.2	4.7	12.8	11.3
Tinda gourd	75.2	6.5	13.5	4.8

Province-wise production share of major vegetables – Agriculture Statistics of Pakistan 2018-2019

YIELD GAP OF IMPORTANT VEGETABLES

The yield of vegetable crops in Pakistan is low, and a substantial gap exists between the potential yields and the yields at the farm level. Production can be increased either by bringing more area under crops or by increasing productivity per hectare. The input use level and combinations are different across farms and regions, resulting in different yields. Furthermore, there is a wide gap in yields of experimental stations and farmer fields, indicating the sub-optimal use of inputs.

Production and yield gap of important vegetable crops in Pakistan

Vegetables	National average yield (tons/ha)	Average yield at expt. stations* (tons/ha)	Production gap (tons/ha)	Yield gap (%)
Potato	18.4	29	10.6	58
Onion	14.0	30	16.0	114
Chilies	1.6	4	2.4	145
Tomato	10.1	30	19.9	197
Turnip	17.6	25	7.4	42
Okra	7.4	17	9.6	130
Cauliflower	17.2	30	12.8	74
Peas	6.7	10	3.4	50
Carrot	17.5	30	12.5	72
Tinda gourd	9.5	25	15.5	163
Garlic	8.5	12	3.5	41
Radish	16.2	30	13.8	85

Cucumber	14.3	20	5.7	40

Source: Fruit, vegetable, and condiments statistics of Pakistan 2018-19.

Apples are grown at 88,589 hectares with an annual production of 564,693 tons. Peach grows over an area of 14,350 hectares, and production is 72,536 tons. Mango, the second important fruit crop, is grown at 167,899 hectares, and production is around 1,735,000 tons. Pakistan contributes 6% to the world's total production and is the third-largest producer of mango. Grapes, a low water-consuming crop, are planted over 15,724 hectares, producing 66,987 tons, and its cultivation is increasing owing to a rise in domestic demand. Guava is widely grown in Pakistan with a production of about 586,070 tons from an area of 64,938 hectares. In Pakistan the dates are grown over 98,415 hectares with a production of 540,606 tons. Other fruits are Banana, Persimmon, and pomegranate, most widely cultivated in selected pockets of Pakistan. It is grown in all four provinces of Pakistan over an area of 8,699 hectares, producing 81,167 tons. Potato, the fourth most important crop in terms of volume, is cultivated in an area of 194,003 hectares with a production of 4,447,776 tons. Chillies are cultivated on 65275 hectares with a production of 148,114 tons. (Fruit, Vegetables and Condiments Statistics of Pakistan 2017-18, Government of Pakistan, Ministry of National Food Security & Research, Economic Wing)

Onion, grown in all four provinces, is cultivated in an area of 149,982 hectares, and production is 2,115,121 million tons. Garlic is the second most widely used cultivated allium after Onion. It is grown in all four provinces of Pakistan over an area of 8,699 hectares, producing 81,167 tons. (Fruit, Vegetables and Condiments Statistics of Pakistan 2017-18, Government of Pakistan, Ministry of National Food Security & Research, Economic Wing)

Figure 1: Area of Fruit Crops in Pakistan 2016-17 & 2017-18

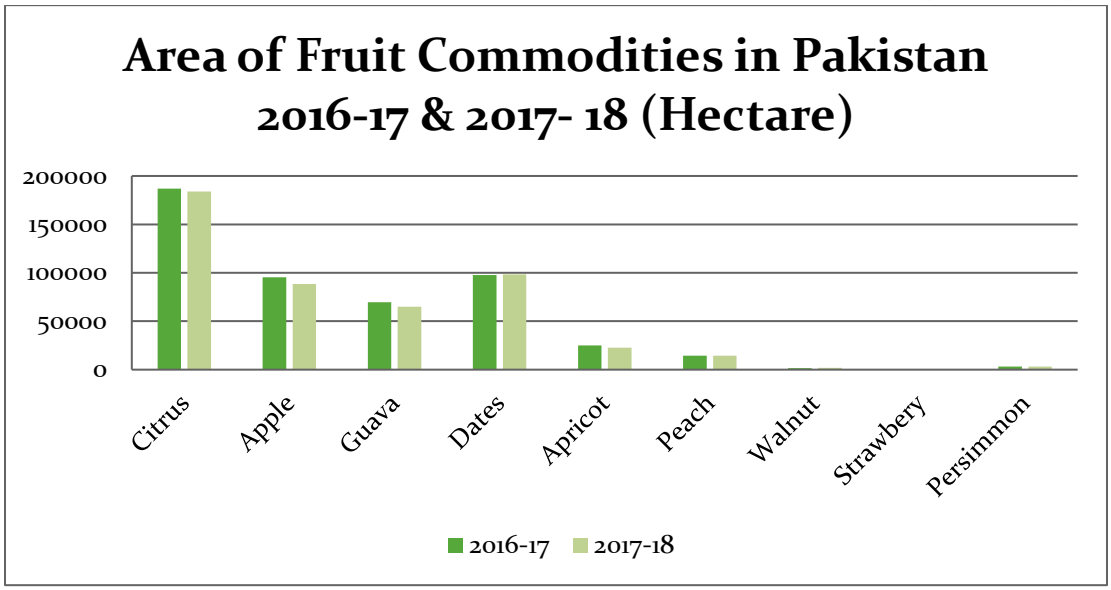
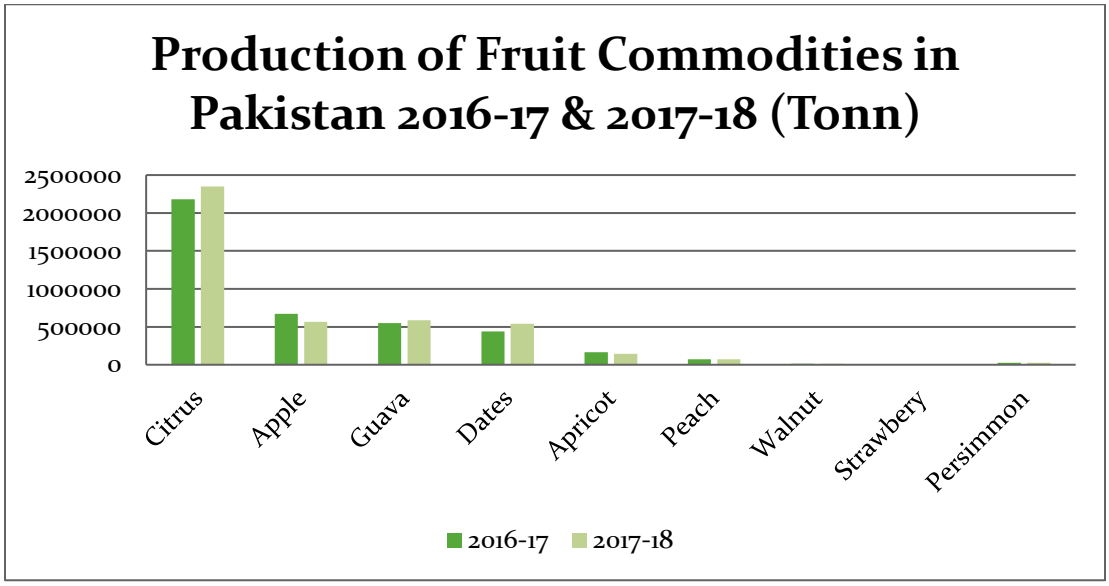


Figure 2: Production of the Fruits Commodities in Pakistan2016-17 & 2017-18



(Source: Fruit, Vegetables and Condiments Statistics of Pakistan 2017-18, Government of Pakistan, Ministry of National Food Security & Research, Economic Wing)

Figure 3: Area of Vegetable Crops in Pakistan 2016-17 & 2017-18

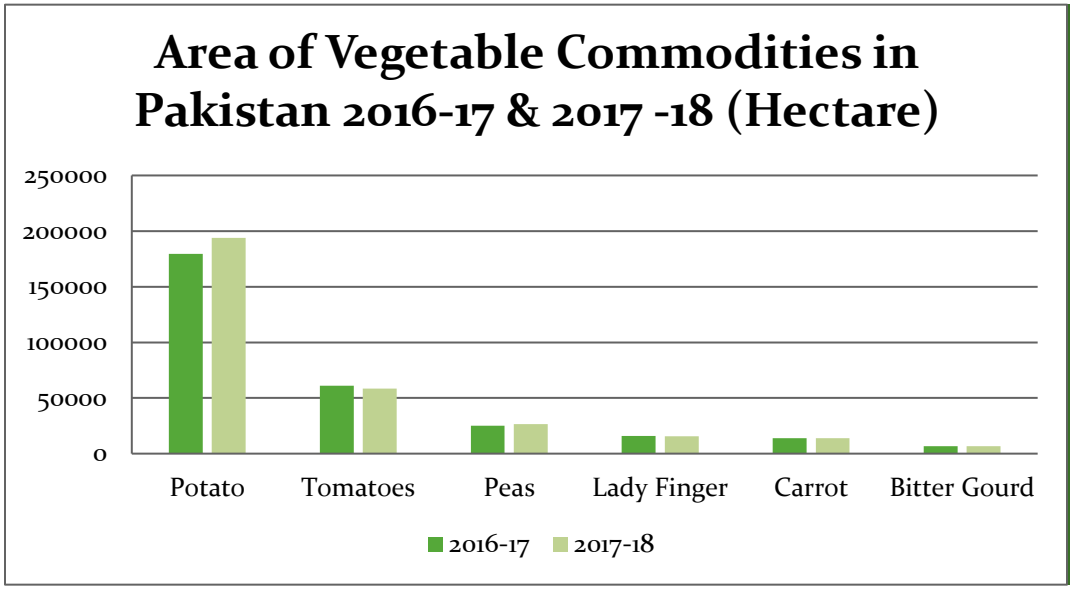
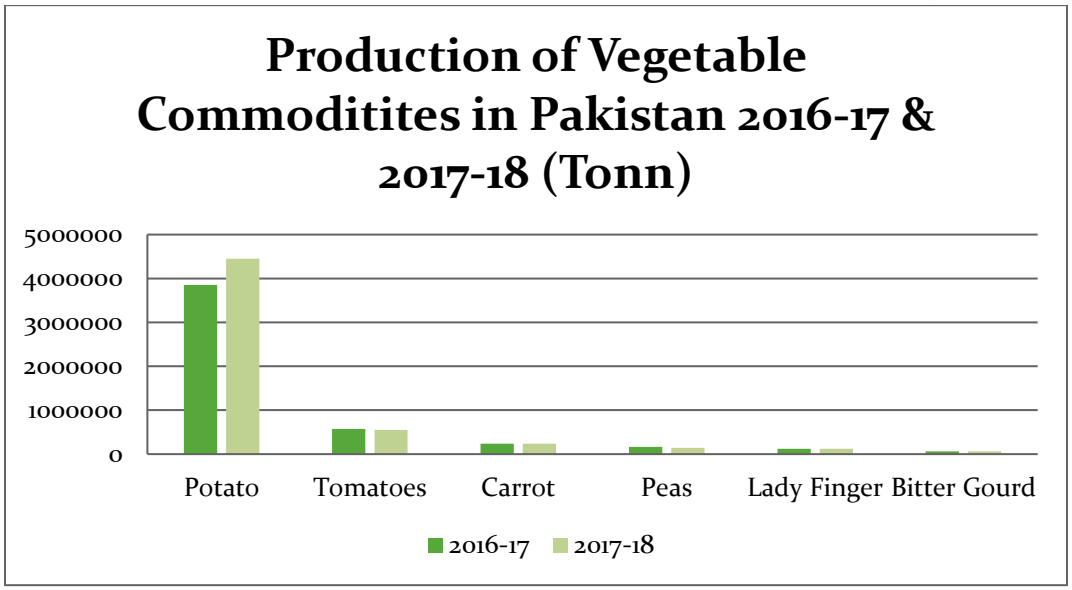


Figure 4: Production of Vegetable Crops in Pakistan 2016-17 & 2017-18



(Source: Fruit, Vegetables and Condiments Statistics of Pakistan 2017-18, Government of Pakistan, Ministry of National Food Security & Research, Economic Wing)

AREA AND PRODUCTION OF HORTICULTURE COMMODITIES- KHYBER PAKHTUNKHWA

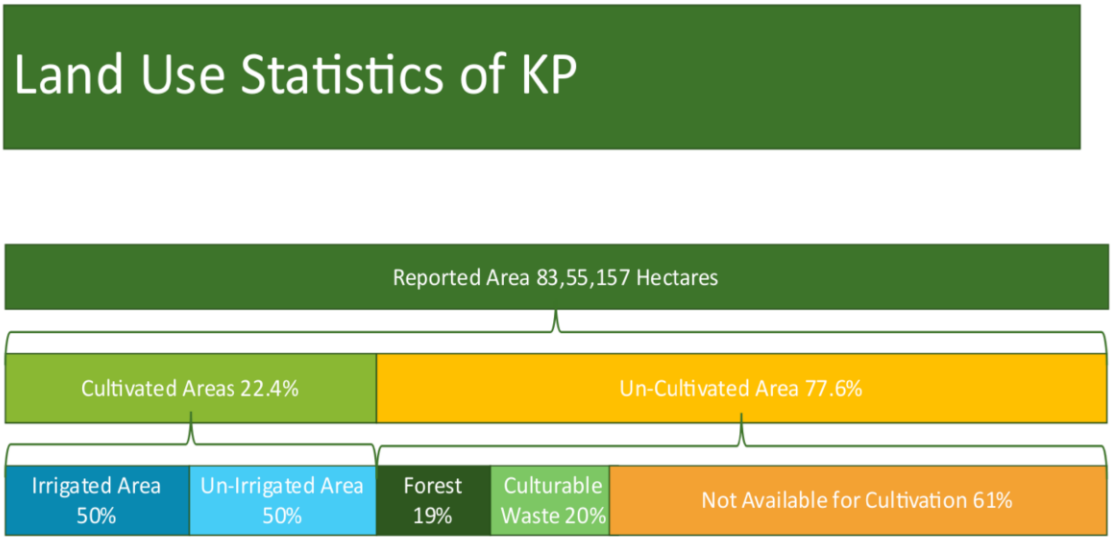
KP Agriculture contributes 22 percent to the provincial GDP and employs 40 percent of the labor force. However, 31 percent of the provincial population continues to be food insecure with a high rate of malnourishment. Furthermore, the tight global food market, volatile food prices, high prices of agriculture inputs, energy crises, increased rate of population growth, the gap between supply and demand, the poor purchasing power of consumers, water scarcity and drought, unprecedented natural disasters and crises in Khyber Pakhtunkhwa had a serious impact on farmers despite provincial government efforts. KP's contribution to the country's agricultural GDP is the smallest of all provinces at 7 percent, compared to its share in total GDP of 11 percent. Also, within KP, agriculture accounts for only 14 percent of the provincial GDP. (The World Bank Khyber Pakhtunkhwa Irrigated Agriculture Improvement Project)

Vegetables Produced in Khyber Pakhtunkhwa: The agro-climatic condition of KP is conducive to the production of a variety of vegetables. Vegetables were grown on 14.2 and 17.9 thousand hectares during 2016-17, producing 167.6 and 166.3 thousand tons in Rabi and Kharif seasons, respectively. The settled areas of the province account for 80 and 83 percent of the total area for vegetables in the Rabi and Kharif seasons, while the rest comes from the merged districts (Table 9). The settled areas account for 86 percent of vegetable production in the Rabi season and 88 percent in the Kharif season. The major Rabi vegetables grown in KP include tomato, turnip, peas,

spinach, and cauliflower, while turnip, spinach, cauliflower, tomato, radish, and carrot are the main Kharif vegetables.

The economy of Khyber Pakhtunkhwa is agrarian, where 80 percent of the total population is rural, with agriculture as their major source of livelihood. The province of KP accounts for an estimated 10.5 percent of the country's GDP and about 14.6 percent of the population (approximately 30.5 million). The per capita income in KP is estimated to be 33 percent below the national average, and despite a sharp and consistent decline in poverty, 27 percent of households are estimated to be living below the national poverty line. Another relevant indicator is the household size, which is strongly correlated with poverty in Pakistan. KP households comprise 7.2 members on average, well above the national average of 6.3 members. Most of KP's population (85 percent) also lives in rural areas, where access to public services and income generation opportunities is lower than in urban centres (fao-pakistan@fao.org).

The total cultivated area of the province is 1.6 million hectares (7 percent of the country's total), half of which is rain-fed. It produces about 5 percent of the country's total wheat, 2 percent of rice, 17 percent of maize, 8 percent of sugarcane, 16 percent of barley, 4 percent of gram, 3 percent of rapeseed and mustard, and 75 percent of tobacco. KP is currently facing a food deficit and depends heavily on imports from other provinces, especially from Punjab, for important commodities like wheat (64 percent), rice (74 percent), milk, meat, sugar (80 percent), and vegetables (90 percent) to complement its production



(*Source: FAO Pakistan*)

The KP province has an ideal environment for growing fruits like Apple, Citrus, Guava, Apricot, Peach, Plum, Loquat, Persimmon, Melon, etc., and vegetables like Peas, Potato, Tomato, Onion, Bitter Gourd, Garlic, etc., which apart from meeting domestic demands, offer great export potential. The ecological zoning of the province indicates that every zone has a different environment, where different varieties of fruits and vegetables can be grown. The northern and hilly areas of Chitral, Swat, and Malakand regions are suitable for high-quality Apple, Peach, Walnut, Citrus, Potato, Peas, and Onion etc. The plain areas comprising Peshawar, Mardan, Charsada, Mansehra, Haripur, and Swabi are ideal for fruits like Plum, Almond, Loquat, Citrus and Persimmon and vegetables like Carrot, Potato, Tomato, Okra, and Garlic, while the Dera Ismail Khan region is suitable for Dates and Melons.

Agro-Ecological Zones of Khyber Pakhtunkhwa

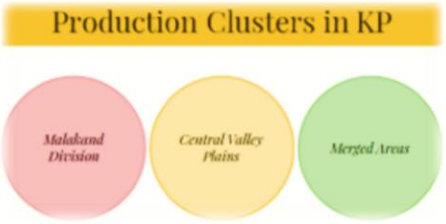
Zone	Sub-Zone	Description	Areas
A	(2)	Northern Dry Mountains	
	A-1	Very Dry, Very Cold Mountains	Chitral
	A-2	Dry, Cold Mountains	Dir (U), Dir (L), Swat, Shangla, Buner, Upper part of Malakand District
B	(2)	Eastern Wet Mountains	
	B-1	Sub-Humid Mountains	Mansehra, Battagram, Kohistan
	B-2	Wet Mountains	Haripur, Abbottabad
C	(0)	Central Valley Plains	Peshawar, Mardan, Swabi, Charsadda, Lower part of Malakand District
D	(2)	Piedmont Plains	
	D-1	Southern Piedmont Plains	Kohat, Karak, Bannu
	D-2	Suleiman Piedmont Plains	DI Khan, Lakki, Tank
E	(0)	Western Dry Mountains	Merged Districts

Peach is the second most important fruit in Khyber Pakhtunkhwa and is a leading cash crop followed by Apple and Persimmon. Due to a range of varieties in Peach from early to late season

the area has increased recently. According to crop statistic of Khyber Pakhtunkhwa 2020-2021, the total area was 1,0081 hectares and production was 69,417 tons. According to a report by the Crop Reporting Service of Khyber Pakhtunkhwa, Swat produced 48,200 tons of Peach in 2020-2021, whereas Peshawar produced 1,050 tons, Mardan 2,939 tons, Malakand 1,292 tons, Lower Dir 1,200 tons, Buner 3,396 tons and Upper Dir 1,935 tons. Total production from the tribal district stood at 5,114 tons (Crop Statistic of Khyber Pakhtunkhwa 2020-2021)

Peach

	Area (Hectares)	Production (Tonnes)	Yield (T/Ha)	International Yield (T/Ha)
Pakistan	**14,315**	**73,916**	**6**	**USA 20**
KP	**10081**	**69,417**	**7**	
KP Share	**70%**	**94%**	**14%** ↑	**186%** ↓



Crop Statistics of Khyber Pakhtunkhwa 2020-2021

Swat valley produces over 100,000 tons of Persimmon fruit with an area of 1800 hectares, and, apart from regular orchards, every house in the upper belt of Swat has two to three Persimmon trees. Persimmon is grown on an area of 100 hectares with a production of 832 tons in Buner, whereas Peshawar produced 695 tons on 71 hectares, Mardan 333 tons on 53 hectares, Malakand 990 tons on 132 hectares, Lower Dir 350 tons on 40 hectares and Upper Dir 2,715 tons on 272 hectares. The total production of Persimmon from KP was 2,994 tons on 2,2983 hectares during 2020-2021 (Crop Statistics of Khyber Pakhtunkhwa 2020-2021).

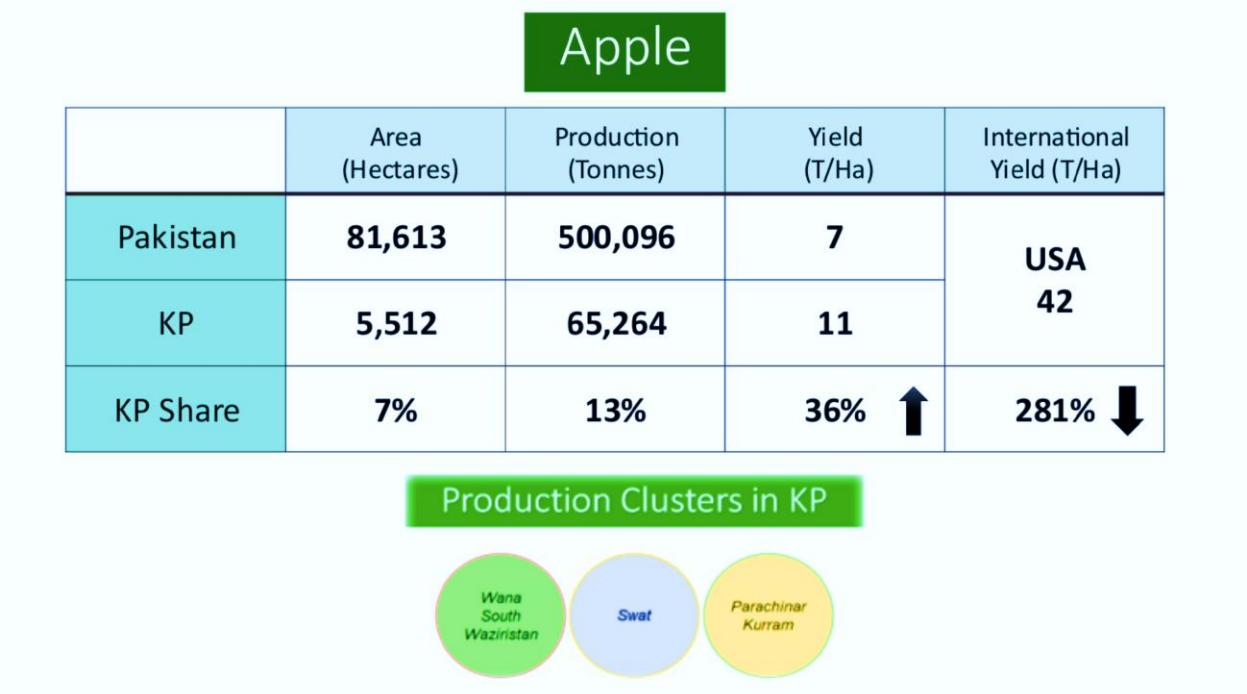
Khyber Pakhtunkhwa province is the largest producer of walnuts, especially the northern mountain districts, including Swat, Chitral, and Kaghan - Naran, with a 60% share in total production in 2020-2021. The estimated total number of fruit-bearing Walnut trees in KP is 170,000 to 200,000, of which district Swat alone has around 70,000 to 90,000 trees. Kalash valley in Chitral, which is well known for its ancient culture, is also rich in Walnut varieties. Kaghan Valley

in KP has a higher population of Walnut trees. Total areas under walnuts in KP are 1773 hectares with a production of 15,121 tons (Crop Statistics of Khyber Pakhtunkhwa 2020-2021).

In Khyber Pakhtunkhwa, Strawberry is cultivated in Swat, Abbottabad, Mansehra, Haripur, Mardan, Charsadda, Peshawar and from Mingora area, runners are supplied to the other parts of the country. It is grown in an area of 388 hectares, and production was 1343 tons during 2018-19 (Agriculture Statistics of Pakistan 2018-2019)

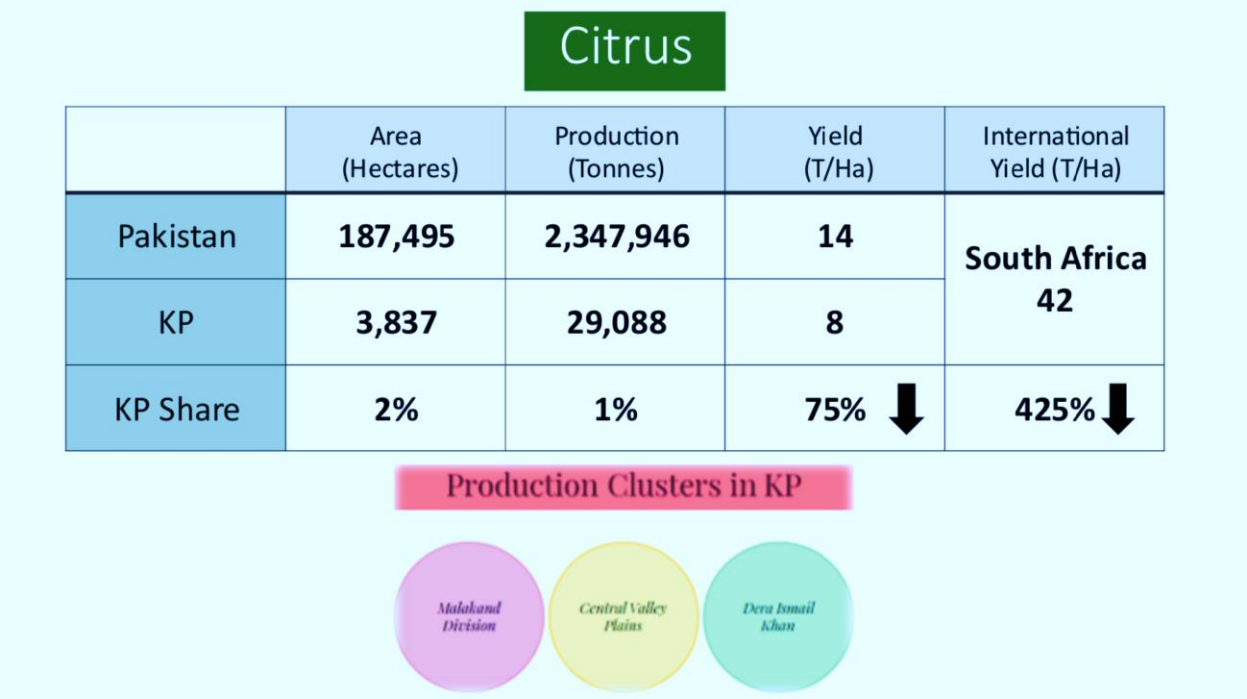
Overall, the area under pear had slightly decreased from 1,395 hectares to 1240 acres. According to data, the area under pear orchards remained unchanged in the Mardan district, while in districts Charsadda and Nowshera, the area under pears slightly declined in comparison to the area under pears 05 years back. Khyber Pakhtunkhwa Dates are grown on an area of 1270 hectares with a production of 14,955 tons during 2020-201. Dera Ismail Khan is very famous for the production of Dhaki variety. It is also grown on a small scale in Bannu and Lucky Marwat.

Baluchistan is the main Apple producing province where 85.05% of production is concentrated and KP is second Apple producing province with 14.39% of the country's production. An important area for Apple cultivation in KP is Swat and South Waziristan. It is also grown in districts Abbottabad, Chitral, and Mansehra. The total area under Apple during 2020-201 was 5,512 hectares and production was 65,264 tons.



Crop Statistics of Khyber Pakhtunkhwa 2020-2021

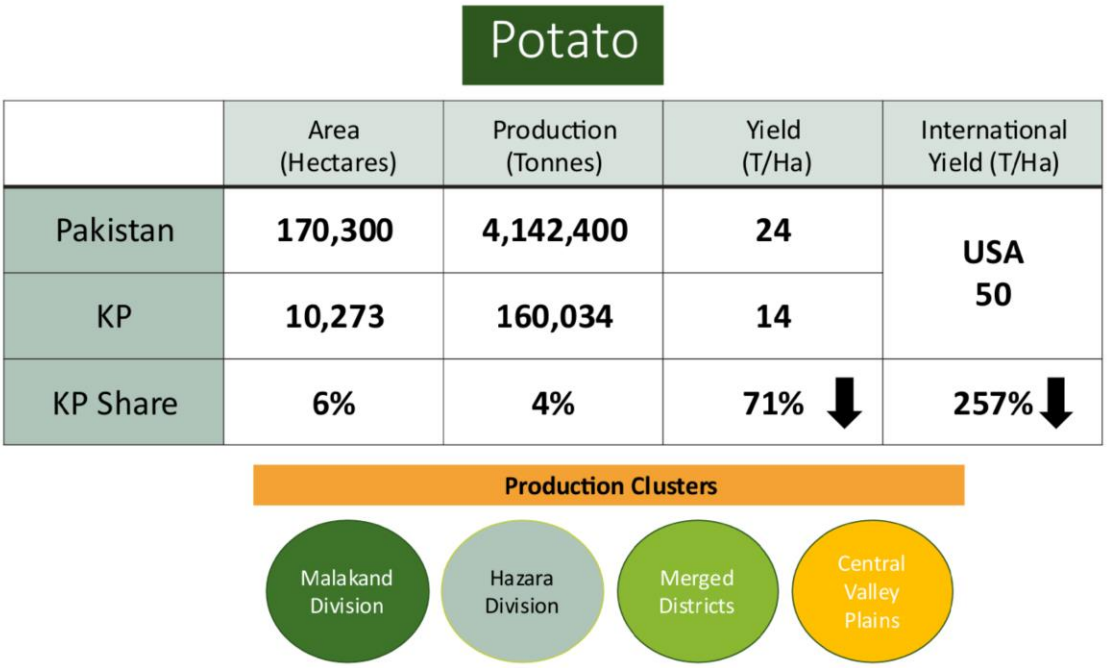
Mardan, Malakand, Swabi, Peshawar, and Haripur are the main districts for Citrus cultivation. The area under Citrus in 2020-2021 is 3,837 with a production of 290,88 (Crop Statistics of Khyber Pakhtunkhwa 2020-2021). Loquat orchards are mainly found in Haripur and also grown in Bannu and Mardan districts were found where the farmers devoted 766 hectares and had a production of 6,846 tonnes during 2020-2021. Guava is mainly cultivated in the district Kohat, Bannu, D.I. Khan, Malakand, and Haripur. Guava contributed 11,361 tonnes of total production from an area of 1,414 hectares. Apricot is another popular crop of KP and is grown on an area of 2681 hectares with the production of 11,235 tonnes during 2020-2021 in the districts of Swat, Peshawar, Nowshera, and South Waziristan.



Crop Statistics Khyber Pakhtunkhwa 2020-2021

The sites of cultivation of Peas in Khyber Pakhtunkhwa are Haripur, Mansehra and Swabi, Chitral and also in D.I Khan. The total area under Pea's cultivation was 1,924.5 hectares, and production was 13855 tonnes during 2020-2021. In Chitral, Pea crop is cultivated in April –May and supply fresh Peas from June to August. In the district, Swat sowing is done from May to August when its cultivation is not possible in other regions of Pakistan due to unfavourable climatic conditions. This region supplies good quality Pea to all major markets of Pakistan from the end of July up to September (Crop Statistics Khyber Pakhtunkhwa 2020-2021).

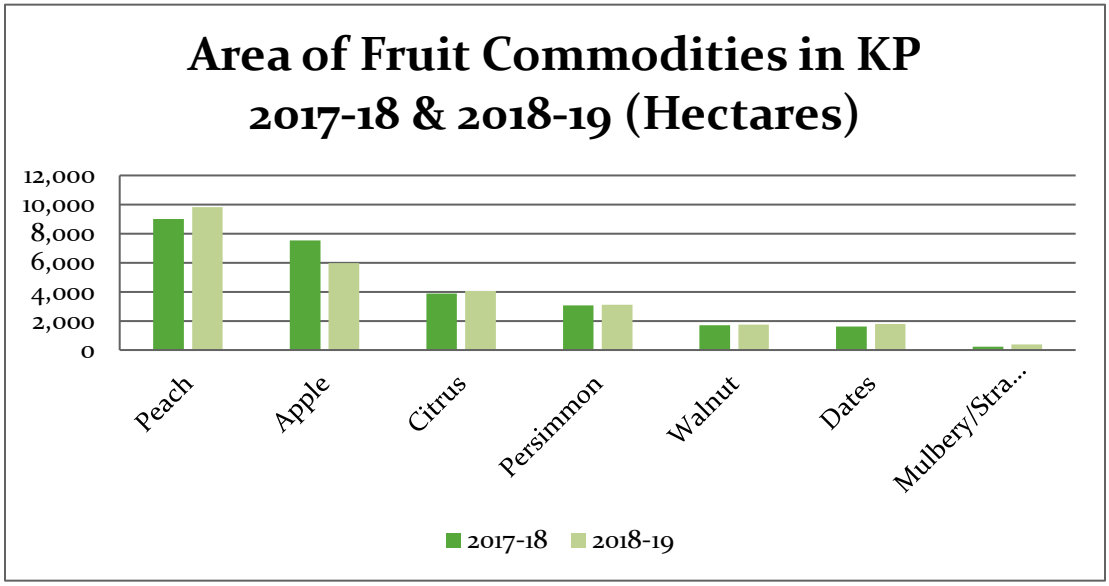
Potato is grown in various districts of KP. In Chitral Potato is mainly grown as Kharif vegetables in an area of 1,390 hectares with a production of 42,688 tonnes, in Nowshera production is 15,599 tonnes from 978 hectares, in Swat, it is grown on an area of 480 hectares with a production of 6,371 tonnes. It is also grown in Mardan, Swabi and Mansehra districts of KP. The total area under Potato cultivation was 10,273 hectares with production of 160,034 tonnes during 2020-2021 in KP (Crop Statistics Khyber Pakhtunkhwa 2020-2021).



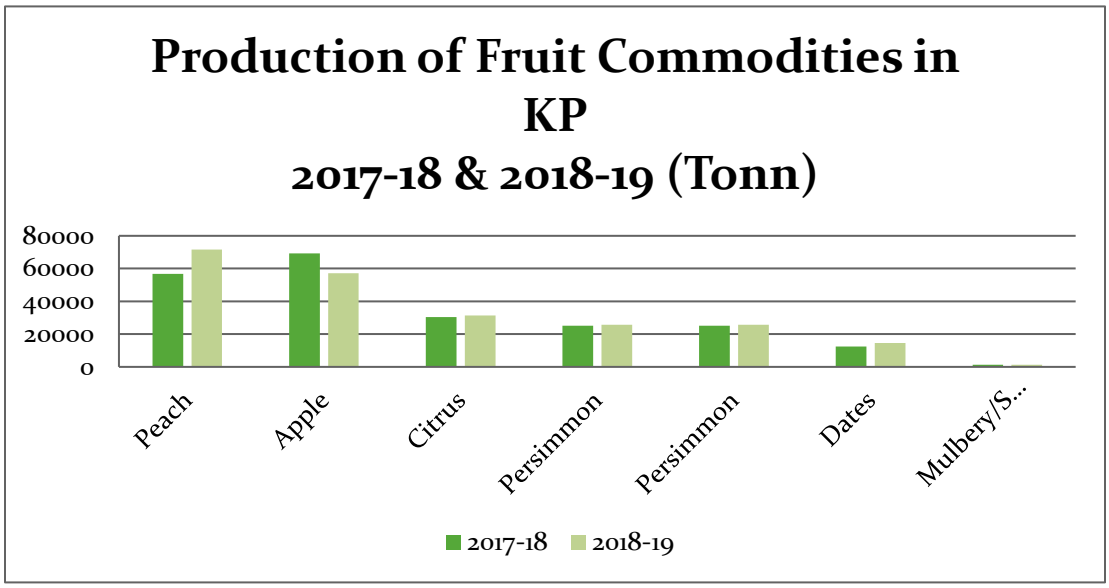
Crop Statistics Khyber Pakhtunkhwa 2020-2021

Other vegetable crops grown in KP are Ladyfinger, Tomato, Bottle Gourd, Tinda and Onion in various districts including Swat, Mansehra, Swabi, Mardan, Peshawar, Haripur, Charsadda, Chitral etc. There was not significant increase in area under vegetable cultivation in KP during 2018-19, which was 22,490 hectares during 2017-18 and increased to 22,651, but production of vegetables slightly decreased from 215,530 tonnes to 214,031 during 2018-19.

AREA OF FRUITS CROPS IN KP 2017-18 & 2018-19



Production of Fruits Crops in KP 2017-18 & 2018-19



(*Source: Fruit, Vegetables and Condiments Statistics of Pakistan 2017-18 & 2018-19, Government of Pakistan, Ministry of National Food Security & Research, Economic Wing*)

PROBLEM STATEMENTS

Despite its significance in agricultural growth, commercial activities and poverty alleviation, the horticulture sector has not received the due attention it deserves. As a result, horticulture has not developed to its full potential. Its slow development reflects a weak policy and regulatory framework, production and productivity problems, post-harvest losses, storage, transportation and marketing problems and limited capital investment. Having five agro-ecological zones, KP has great potential for the promotion of the horticulture sub-sector, but the same could not be harnessed. Besides the above, other constraints in the horticulture subsector in KP are expensive refrigerated transport, costly good quality packing materials, non-availability of credit on easy terms and conditions, policy support from the government and lack of a high technical lab for certification. One of the major problems in horticulture marketing is the highest producer-consumer ratio, i.e. the producer's share in the consumer rupee is less than one-fourth; the rest of the three-fourth share goes to other market players (contractors 39%, commission agents 7%, wholesalers 9% and retailers 19%). The producer is at the lower end of the receipt of the gross margin. The majority of the farmers sell their produce at the wholesale market through contractors during the flowering stage to the middlemen, a commission agent. Transportation of fruits and vegetables is done in the same truck from the farm to the market. The same truck is used for animal transportation. On a limited scale, reefer trucks have been introduced in some parts of the country. Packaging is done by using local materials, but such packages fail to maintain the freshness and quality of the products. Absence of cooling and packaging centres and inadequate cold storage facilities to preserve products near the wholesale markets. A few cold storage facilities are identified. No cooling and packaging house centres and cold storage facilities are available near the farms that can be used by the producers. The current value chain have negative impacts on the share of the farmers in consumer prices which is about 15-20 % of the retail price, benefits of high retail prices are disproportionately expropriated by the middle men, producers did not get dividend when the production is low due to bad weather, when there is a market glut, the producers suffer as their share in the retail price also falls significantly. Post-harvest loss is 30-40% due to a lack of extension services, mishandling of perishable products, inadequate storage facilities, processing and market infrastructures. An estimated reduction of 75% of the current post-harvest losses, when valued at export, will be enormous. Poor market infrastructure, poor market management, and poor financial management of markets are also issues in horticulture.

MAJOR PROBLEMS ARE ENUMERATED AS UNDER:

i) Shortage of quality and high yielding seeds;
ii) Lack of verities aligned with global demand;
iii) Weak skills;
iv) Seasonal water shortages;
v) Limited financial resources for investment and access to credit;
vi) Intellectual property rights;
vii) Inefficiencies in inputs markets;
viii) Poor on-farm sanitary and phytosanitary (sps) standards;
ix) Old and unhealthy fruit trees prone to disease;
x) Low density of trees per unit of land as opposed to high density planting in many countries;
xi) Proliferation of nurseries with substandard and unhealthy saplings;
xii) Inadequate fertility management and application of balanced fertilizer and micronutrients;
xiii) Lack of knowledge of integrated pest management and indiscriminate use of plant protection agrochemicals; (xiv) ineffective/inadequate extension services;
xiv) Lack of capacity for required capital investment;
xv) High post-harvest losses for both fruits and vegetables;
xvi) Low compliance to safety standards and health certification protocols;
xvii) High production cost and low net margin;
xviii) Lack of adequate and timely market information in terms of demand for high quality fruit and value-added fruit products in domestic as well as export markets and price; and
xix) Monopoly of contractors, commission agents/brokers as they provide finance and credit informally;
xx) Low agro-processing facilities; and
xxi) Low variety diversification aligned with global demand, absence of grading and standardization system, and development of packaging houses, cold chain, marketing, proper logistics and processing units.

These problems contributed to low quality standards, minimal export of horticulture products, and low rates of return on investment, which consequently fail to attract new investment. This paper explains the ground realities about the horticultural sub-sector of KP and suggests a strategy to develop this sub-sector to its full potential. A viable and profitable horticulture sector can provide a sustainable livelihood to the rural farming community and earn foreign exchange. However small land holding precludes the possibility of horticultural cultivation on commercial lines. Great potential for horticulture due to the variety in land and climate, which provides

opportunities to produce a wide range of horticulture crops. Besides producing a large number of indigenous fruits, vegetables, there is scope for the cultivation of exotic crops. Pakistan occupies a prominent world position in terms of production, i.e., apricots (6th), date palm (5th), Onion (7th), mandarin (6th), mango (4th), etc. Below are some of the bottlenecks that hinder the production and export of Fruits & Vegetables. Strong action will be needed for dismantling the disproportionate market power of those using their influence to hijack and format agricultural and food systems to serve their own private interests. A growing consensus has emerged on the need for proceeding to major changes in agricultural and food systems in order to ensure that the province can feed itself to day and in the future, with healthy and nutritiously high-quality food, while contributing to eradicating poverty, conserving biodiversity and natural resources, mitigating and adapting to climate change in a resource constrained Khyber Pakhtunkhwa. **"Business as usual is no more an option".**

COMPREHENSIVE HORTICULTURAL POLICY

The vision of the policy should be

"***Transforming Khyber Pakhtunkhwa's horticulture sub-sector into a vibrant, sustainable, market-driven, and export-oriented."***

We need to formulate a comprehensive horticultural policy which should indicate the broad direction, create institutions and define their respective roles, make rules for coordination, set safety standards and provide an incentive and rewards system for various stakeholders within this framework. The Government's role should be confined to policy formulation, regulation, capacity building and facilitation, while the private sector will take the lead role in investment and value chain development, on its own or based on public-private partnership. Within the national and provincial policy settings, horticulture will be developed with the following five broad objectives.

INCREASING PRODUCTIVITY

Increase productivity by improving capacity, increasing efficiency in all horticultural operations through public as well as private sector investment in R&D and Extension. Increase profitability by rationalizing input and output prices, reducing production and post-production losses and developing an efficient marketing infrastructure. Make horticultural produce competitive in the rapidly globalizing world by reducing the cost of production, improving quality, and ensuring Sanitary and Phyto-Sanitary (SPS) compliance.

GOOD HORTICULTURAL PRACTICES

Ensure sustainability by promoting environment-friendly good horticultural practices through incentives and rewards, awareness campaigns and promulgation of appropriate legal framework,

and ensure equitable distribution of gains from enhanced productivity by making available public sector goods and services to all stakeholders without distinction.

CREATING JOBS IN THE HORTICULTURE SECTOR

Accelerating the national economic growth by increasing the rate of growth of this important Sub-sector of the economy and reducing unemployment by creating jobs in the horticulture sector. Increasing Pakistan's foreign exchange earnings by increasing quantity, quality and variety of horticultural exports, ensuring food security and nutritional balance of the people's food intake by providing them vitamin rich horticultural products, helping the state in its poverty alleviation efforts by providing them a labour intensive, low capital-intensive investment, improving the condition and status of women by providing them opportunities to own resources.

HORIZONTAL EXPANSION

There is a vast scope of horizontal expansion in respect of horticultural products due to their agronomic qualities, new techniques of tunnel farming and drip irrigation have revolutionized this sector, increased productivity in crop sector can release additional lands for horticulture even marginal/mountain lands, not fit for profitable cultivation of cash/food crops can be brought under fruit/vegetables.

INCREASING THE AREA UNDER HORTICULTURAL PRODUCTS

Degraded lands, not fit for profitable cultivation of cash/cereal crops, can be brought under horticultural production with the help of technology, chemicals and water, new techniques and technology for saving water have made it possible to use this land for horticultural production on a profitable basis.

INTERCROPPING

Encourage eco-friendly inter-cropping practices as it increases the area under cultivation by cultivating vegetables in between rows. Farmers can plant crops in orchards to increase their profitability. Agroforestry is another profitable option for farmers and the province; however, farmers must be given proper technical support for this practice to be cost-effective and eco-friendly.

URBAN/PERI-URBAN FARMING

Increased urbanization is devouring expropriation of prime agricultural lands for the construction of spacious houses and infrastructure, besides formulating appropriate land use policy, the government should encourage urban and peri-urban farming by utilizing the vacant areas and promoting kitchen/homestead gardening. Modern techniques and technology have made it

technically feasible and financially cost-effective to go for this form of micro farming, proper guidance, availability of urban farming infrastructure, and timely technical support can provide incentives for urbanites to become part-time farmers.

AGRICULTURAL EDUCATION AND RESEARCH

Our agricultural Research & Development and Extension suffers from many structural, coordination and management weaknesses. Low funding, weak linkages among farmers, research, education & extension, inadequate technical/professional capacity of research institutions, promote demand driven quality R&D by encouraging public-private partnerships, linked to horticulture value chains/extension services, R & D programs must focus on field-oriented problems, finding solutions for increasing productivity, broaden harvesting time of crops and increase farmers' profitability.

INPUTS AND SEEDS

New varieties should be introduced. Seedless varieties of some new horticultural products have already been introduced. These need to be promoted as commercial crops. Potential new crops should be identified, especially high-value horticultural crops suitable for local climatic conditions and climate-resilient. Biotechnology as a tool for rapid multiplication of quality planting material, virus cleaning, and genetic transformation has significant potential but requires capacity building and safeguard procedures.

Effective fertilizers play a key role in helping farmers to achieve their high levels of production. In KP there are several problems which impede the balance and efficient use of fertilizers i.e. non-availability of specific fertilizers at the right time, ever-increasing prices, improper application methods and time, lack of knowledge among farmers about the need for balanced fertilizer applications, adulteration and inadequate grant of soft loans especially for the small farmers, constituting 75 per cent of our farming community.

The fertilizer recommendations are too general. Soil testing laboratories are not adequately equipped in terms of manpower and equipment. As a result, the majority of the farmers become resource-poor and cannot get benefits and therefore, our crop yields are one of the lowest in the world. Fertilizers are not cheap and therefore, it is essential that they should be efficiently and effectively used to produce a maximum increase in crop yields so that farmers receive the best possible outputs from their expenses.

Integrated and balanced fertilization for fruits and vegetables ensures optimum plant nutrient uptake. High application rates of chemical fertilizers result in inefficient use of nutrients and contribute to environmental risk due to soil and water contamination with fertilizer residues. Promotion of balanced fertilization using a combination of organic and inorganic sources may

improve crop production leading to increased sustainability and profitability. Inorganic fertilizer solution also promotes the release of nutrients from organic fertilizers and composts.

SKILL FORMATION

Skill development through in-service training at different R&D institutions can enhance the capabilities of extension staff. Postgraduate programs in fruits, vegetables, floriculture, medicinal and spices crops and post-harvest management should help provide skilled human resources for the horticulture industry. Such programs should be initiated in agricultural universities and research institutes in the province. Skilled labour should be attracted and retained through competitive minimum wages for agricultural labour and the development of industry vocational training programs.

FARM MECHANIZATION

Intensification and diversification of farm mechanization by ensuring easy access for farmers to essential horticultural machinery. It's efficient and optimal use by incentivizing the private sector to open machinery leasing/hiring outlets in villages. Federal Government should exempt the duties and surcharge on import of horticulture machinery like grading units, cold storage chambers, greenhouses and trickle irrigation accessories such as micro-tubes, mini sprinkler and bubblers for interested businessmen, expansion and modernization of local machinery manufacturing by providing them training, incentives and technical/financial support to produce horticultural implements as per international standards.

AVAILABILITY OF TRUE-TO-TYPE PLANTING MATERIALS

Limited availability of true-to-type planting material is the biggest handicap in establishing state-of-the-art fruit and vegetable nurseries in the province. The state should promote the establishment of such nurseries by providing appropriate legislative cover, financial support and technical guidance; all nurseries must work according to the approved nursery protocol, developed in consultation with technical experts and stakeholders. Only registered nurseries should be eligible for support and facilities offered by the government.

- Further, there is limited availability of certified seeds, and pure fruit germplasms are mainly due to a lack of many practical, theoretical, and socio-economic constraints to access and use of germplasm collection, like seed multiplication, processing, storing and distribution. National plant quarantine regulations, which are a necessary precaution against the accidental spread of pests and diseases, also hinder the flow of germplasm. Legislation of plant variety rights, lack of documentation, lack of evaluation and characterization are other factors affecting the introduction of high-yielding, insect pest and drought-resistant germplasm. So, research on more efficient conservation technology is required. Collaborative efforts among academia, research,

extension, as well as the federal and provincial research systems will help to undertake strategic research.

NON-USE OF APPROPRIATE CHEMICALS

There are various estimates of production losses due to non-use of appropriate chemicals by the farmers, Ignorance, fear and costs of using-general reasons for this neglect. There is need to create awareness among the farmers for judicious use of chemicals for reducing the production losses. There are eco-friendly measures to reduce this loss for those who are excessively conscious of the use of chemical inputs.

WATER USE

Water was already scarce, but its scarcity is becoming acute due to its increased demand, misuse, wastage and climate change. There is thus a need to rationalize its use even for farming purposes where it is wasted the most. New water-saving techniques and technologies have provided hope for mitigating its impact. Innovative methods such as rainwater harvesting and recycling of sewage water for kitchen gardening need to be encouraged.

Global climatic changes result in either scarcity of water (drought) or excess water (flood). Water is increasingly becoming a scarce resource even in the humid tropics. The situation is worse during the dry season in most of the developing countries. With this scarce resource, there is a need to develop technologies that promote the efficient use of water and fertilizers in vegetables and fruits production. Compared with furrow irrigation, drip irrigation uses less water, improves yield and quality of fruits and vegetables, promotes efficient use of fertilizers and reduces the risk of groundwater contamination.

CREDIT

The sector is informal, and the profit margin is low, which has diverted investment to other sectors. Lack of financial resources and high interest rates of financial services available are the biggest handicaps for its growth. The government should facilitate soft loans for the promotion of the horticulture industry for a period of five years. The government should facilitate the stakeholders involved in the horticulture business to access commercial credit by reducing compliance and transaction costs.

PROCESSING

Provide information to the growers on harvest technologies of fruits, removal of field heat, grading of the produce and appropriate packaging. Post-harvest losses must be examined, and programs planned to minimize these losses, when financially viable, through linking production to agro-

industrial transformation and through encouraging the private sector to build cold storage. The development of appropriate packaging technologies that minimize product damage.

MARKETING

The marketing of horticultural products is supply-based producers being price takers and receiving lower prices during high supply periods. The government should develop integrated value chains with producers and producer groups as an integral component of these value chains. Prioritize the building of contract farming, collaborative marketing arrangements with processors, etc. Establish a market information system, including price-clearing houses of agricultural commodities in provincial/federal capitals.

LOOPHOLES IN MARKETING SYSTEM AND SUPPLY CHAIN

Fruits and vegetables are riskier to produce than many other crops. The variability in the yield of horticultural crops is 2-3 times more than that in agronomic crops. Similarly, Marketing functions are performed in a traditional way, and markets for fruit and vegetable products may not function efficiently. There are generally great differences between prices paid by the consumer and those received by producers. It is generally perceived that marketing agents exploit producers and consumers by charging a fixed and high margin on their investment. In Pakistan, the marketing of horticultural crops is dominated by the private sector. The main cause is the disequilibrium in demand and supply at peak production. Early and late season market prices of fruits and vegetables remain high. Among market traders, contractors, and retailers obtain the highest absolute cash margins, net profit margin, and share in consumers' prices. The main victim in this crisis is the producer, the farmer, who has no voice to call for the remedy.

The attention of the policymaker is required for the survival of the producer.

- To lower the shares of contractors in the consumer rupee
- Unstable prices
- Improvements in transport infrastructure
- Availability of good-quality packing material
- Non-involvement or low participation of growers in the market committees
- Poor infrastructure of the wholesale market
- No proper auction platforms
- Sub-standard storage conditions
- Poor hygiene and sanitation conditions of the marketplace

Proper record management is needed at the wholesale points for record-keeping of traded volumes. This will help to understand the demand and supply of the commodities and thus support farmers for future planning as well. All these do not require a big investment, but need

better management to improve the quality of the marketing system. Many wholesale markets (mandi) were built years ago and are unable to cope efficiently with increased transactions.

These are some of the major factors in increased marketing costs and physical losses of farm products. Hygiene conditions, particularly in the case of fruits, vegetables, and livestock, are quite dismal. Excessive domination of commission agents, lack of physical and allied facilities and an ineffective market information system are some of the inherent problems of these markets and are putting farmers in a disadvantage situation while selling their produce.

VALUE ADDITION

The government should promote public-private partnerships and provide incentives/support for value addition and value creation through the development of Environment-friendly packaging/packaging industry, cold chain infrastructure, and wholesale market infrastructure. Fruit and vegetable processing and dehydration industry, integrated pest management industry and services, organic and herbal/medicinal crop production/processing, enhanced quality should be enforced in accordance with World Trade Organization's (WTO) requirements.

It becomes necessary that the processing of fruits and vegetables must be augmented by developing such techniques, which would be not only feasible but also would suffice to produce economically quality products economically. The most common method for the preservation of fruits and vegetables is the dehydration method. The vegetables can be dried by a hot air-drying method for small-scale operation or by a conventional tray drier or vacuum drier, and at home, the small-scale produce can be processed by the sun-drying method. Vegetable powders such as Onion, Garlic, and leafy vegetables can be prepared with simple technologies and can be incorporated in traditional food preparations, thereby adding value to the products and attaining food and nutrition security both.

Processing involves, to varying degrees, an actual physiological change in the original commodity. There is a vast range of technology that can be adapted for each type of commodity. The limitations, however, are the availability of inputs (i.e. machinery, ingredients and containers), as well as the availability of expertise or know-how. Processing includes dehydration, drying, canning, juicing, picking and freezing. There is quite a variety of technology available for each type of treatment. For instance, dehydration technology ranges from the centuries-old practices of sun-drying and smoking to the highly sophisticated techniques of freeze-drying.

To develop the fruit and vegetable processing industry in the KP on sound footing, it seems imperative that various constraints (Consumer food habits, cost of products, seasonality, product quality, etc.) need to be removed, and other conceptual, technological, operational and administrative defects should be rectified. The processing industry has ample potential and viability to develop, sustain and contribute towards the economic development of the country

once it is treated affectionately in the "teething stage" by the Government by providing liberal technical and financial assistance or in other words, by giving "most favoured industry" treatment.

QUALITY CONTROL

Horticulture production should be based on quality, which will promote exports, for which accredited quality control and testing laboratories must be established to certify the quality of the produce for exports and in the domestic market. A coherent sanitary and phytosanitary (SPS) management system for strong coordination and effective interaction between various departments involved in inspection, testing and other related activities should be facilitated. The regulations and procedures of export and import of horticulture industry commodities should be reformed to reduce compliance and transaction costs as part of achieving efficiency gains.

DIVERSIFICATION

Besides increasing the production of indigenous fruits and vegetables, we have to diversify our horticultural portfolio by promoting the cultivation of exotic fruits and vegetables which are in demand at a global level. This is a centuries-old process and continuing all over the world. We will not face many problems, as our terrain and climate are suitable for the production of a variety of exotic horticultural products. We need the services of marketing people and researchers to find globally traded products, which can be grown here from an agronomic point. Organic farming is another niche area which needs to be exploited by providing an appropriate legal framework and proper incentives and support, which should be promoted.

PRODUCTION RELATIONS

Production relations relate to the way land is owned, cultivated and crops are disposed of. In Pakistan only two types of production relations are in vogue i.e. owner cultivation and tenant cultivation. Promote three other modes which are essential for modernizing our horticultural transformation –cooperative, contract and corporate. These are in operation in some areas but with limited success. The time has come to provide a comprehensive legal framework and institutional mechanism to streamline these production relations.

FORMULATION OF COMPREHENSIVE LAND USE POLICY

Developing a national land use policy for the rational use of land resources is the need of the day, as valuable arable land is being converted for non-farming purposes at alarming rates. Add to it the declining fertility of our agricultural lands due to non-sustainable agricultural practices, plus the degradation of our lands due to waterlogging and salinity going on for decades, a negative side effect of our irrigation practices. Lastly, we are misusing our scarce land resources as we are cultivating crops on lands extremely suitable for horticultural use. All these issues needed to be addressed by formulating a long-term, comprehensive land use policy by the government.

IMPROVING RURAL INFRASTRUCTURE

The government should facilitate the development of modern infrastructure (wholesale markets, pack houses, cold stores, reefer containers) under public-private partnerships, managed by the private sector. Improvement of infrastructure like roads in the hilly and remote areas of KP for the safe and cheap transportation of horticulture commodities, developing airport facilities for wide bodied cargo planes to land at airports in the main production areas, improving and storage facilities at ports providing one window operation and establishing effective and viable cold chain development.

ENVIRONMENTAL SUSTAINABILITY

Create awareness among farmers about the looming threat of climate change/environmental degradation, popularizing the good, sustainable agricultural practices. We will have to synchronize the extension services of the provincial agricultural departments and marketing outlets of the private agro services providers to promote environment-friendly practices. The government should promulgate legislation for stopping practices aggravating the threat of climate change and allocate resources for carrying out research to develop varieties responsive to climate change. They need to look into adjusting the cropping pattern and fine-tuning the planting and harvesting schedules, practising crop rotation and diversifying crop mix.

GENDER MAINSTREAMING``

All the non-crop agricultural activities provide excellent opportunities for accelerated gender mainstreaming. Even presently, women play an important role in livestock husbandry, poultry farming, dairy production and horticultural cultivation. Targeted attention to create gender balance through skill formation, awareness campaign, financial assistance, and technical support can yield handsome dividends in a short period. It will also help the government in its efforts to reduce rural poverty

RURAL NON-FARM SECTOR

The agricultural sector cannot grow to its full potential unless the rural non-farm sector develops along with its formal farm sector. Development of efficient and effective agri-based supply chains that link the agriculture sector with their corresponding upstream and downstream links in the rural non-farm (RNF) to the national and international markets. RNF provides 40-60% of incomes/jobs in rural areas, much of its activity occurs in the trading, services and processing sector having strong forward and backward linkages with agriculture, Informal and low capital using entities catering mostly to domestic markets, RNF presents opportunities for providing value addition to primary production at the farm level.

INTRODUCING NEW EXOTIC PRODUCTS

Pakistan has a great potential to increase its horticultural production by bringing in new areas under cultivation of horticultural products; however, there is a need for introducing new exotic products in its horticultural portfolio, improving the productivity, adding value and increasing its exports. To do so, it will have to put more resources into research and development, extension, improving marketing infrastructure, improving processing, etc. This demands a lot of resources, which can be provided by the private sector, local and foreign, if we fine-tune our legal framework supported by an appropriate institutional mechanism and add a strict dispute resolution mechanism.

RISK OF DISEASE

Horticulture crops are at a greater risk of disease than agriculture, and changing climatic conditions have exacerbated the problem. Having said that, the introduction of safe and modern medicines is not an easy task in our country. Chlorpyrifos, Paraquat and many such chemicals, which are banned in developed countries such as Europe and North America, continue to be sold in Pakistan, resulting in the continuous production of unsafe horticulture produce.

FARM PRODUCTIVITY.

In farm productivity, it was observed that per ha yields of only six out of 29 commodities in Pakistan are higher than the world average yields of the respective commodity. In addition, during 2001-17, lower growth rates in yield than the world average have been recorded in 21 out of 29 crops; thus, the comparative advantage in these crops is expected to further deteriorate if these trends continue in the future. Although causes of low per ha yields are identified in each commodity report, generally it is because of a lack of producers' access to advanced and high-yielding technologies, varieties and planting material and their ability to adopt these technologies. Water shortage has become a serious issue, which affects productivity in many clusters.

HARVEST AND POST-HARVEST LOSSES.

These losses in Pakistan's agriculture, both in terms of quantity and quality, are high, ranging from 20-50%, mainly because of poor harvest and postharvest management. About 5-15% of these losses occur at the harvesting time; aflatoxin infestation is common in many agricultural commodities; high pesticide residue and lack of traceability and certification are emerging issues bothering the traders, which reduces the country's chance to compete in national and international markets.

TRADE PERFORMANCE

It has been analyzed that out of the total 29 commodities where comparable export data is available, 16 commodities have low growth potential in both quantities and values when compared with the respective world averages. Out of 24 crops where export production ratio data is available (others are mainly imported commodities), Pakistan has only six crops where the ratio

is higher than the world average. However, except for potato, the rate of increase in export-production ratio in these commodities is also either less than that at the global level or even declines over time. Thus, Pakistan brings a far smaller proportion of its production to the international market. The causes of low or deteriorating export-production ratio root from the poor value chain development of the commodity, inefficient commercial policies and strategies and weak knowledge and link of the traders with international markets. Improving traders' link with international markets and improving the value chain of agricultural commodities can greatly enhance the export-production ratio of these commodities.

QUALITY OF PRODUCE

In comparing the quality of these 33 tradeable commodities, wherever relevant for international markets, it has been observed that out of the 24 commodities exported (except sugarcane), Pakistan could not earn an export price equal or higher than its average export price in the world. This finding suggests that Pakistani exporters fail to meet the quality standards of the consumers in the importing countries. Similarly, in the domestic market, the prices of the imported commodities are usually found to be higher than the domestically produced product, again suggesting the low quality of the latter. Lack of investment in value chain development is the main cause of Pakistan's failure to achieve the world average export price. Sometimes, the failure of Pakistani traders to present the product in a manner that the importing country's consumers prefer is also a cause. Many domestic consumers also complain of failing to get the desired quality in the domestic market.

In KP like across Pakistan, fruits and vegetables are traditionally packed in woven bamboo baskets, plastic boxes and wooden boxes made of para-rubber wood. Since the packages did not effectively protect the produce during transport, it poses tremendous losses. In addition, these packages were uncompetitive in the world market, in terms of appearance, ease of handling, use and disposal, and strength properties.

Because of poor packaging, fruits and vegetables are often found dumped in the supermarkets and only those consignments in proper packaging like bags made of nylon ropes or plastic trays with holes in them for aeration are showcased.

In recent years, local packaging industry has come up with a broad new range of fruits and veg' packaging containers, cases, boxes, crates, bags and these things are also routinely imported from various countries. The problem lies with the mindset of some exporters who, instead of taking a long-term view of export markets, try to earn money and compromise on packaging.

SMALL-SCALE PROCESSING.

Despite a great potential for small-scale processing of agricultural commodities, very little of the agricultural produce goes into such processing in rural areas. For example, most of the tomato puree is imported from China, which can be processed through small-scale puree plants in rural

areas. Mechanical sun drying of several fruits and vegetables, etc., can not only reduce post-harvest losses and improve produce quality but also add value to raw agricultural commodities and reduce seasonal price fluctuation. Small-scale juice/pulp making in mango, apples, tomatoes and many other fruits is are viable business venture in rural areas, provided processing and hygienic standards are maintained.

FARM AND VALUE CHAIN OPERATIONS

Several farm and value chain operations conducted manually or unscientifically are too inefficient; these include planting/transplanting, harvesting, transportation, packing and drying, etc. For example, manual planting of vegetables not only involves muscle drudgery but is also inefficient. The open sun drying of many fruits and vegetables reduces quality. Manual harvesting of many fruits is inefficient and causes huge losses and deterioration in quality. These existing practices significantly reduce Pakistan's competitiveness as it increases the value-chain costs,

❖ RESPONSE TO CLIMATE CHANGE

To confront the challenge of climate change, many efforts are made around the world. Various climate change policies are established at international, national, subnational, and local levels to address the impacts of climate change. Traditionally, the focus of such policies remained on mitigation instead of adaptation measures, despite urgent requirements for adaptation strategies being emphasized. Adaptation actions are an important response to climate change, as these actions help to reduce the vulnerabilities in the social and biological systems. One of the major objectives of adaptation measures is to build resilience in societies to face climate change.

The need for adaptation policies and actions is increasingly recognized. Governments are being forced to rethink their ways to manage climatic impacts and to focus not only on mitigation but also adaptation. Due to increasing public interests, the adaptation policies are being recognized and gaining space on policy agenda. In the case of most vulnerable countries to climate change, adaptation is the focus of their strategies to tackle the negative consequences of climate change. To manage the potentially fatal issue of climate change, Pakistan responded with various initiatives, mainly on adaptation measures. These initiatives are in the form of climate change policies, implementation frameworks, and some other measures.

The subnational governments are key institutions for the effective implementation of climate change-related policies. Pakistan recognizes the important role of subnational governments/provinces for an effective response to climate change. After the 18th constitutional amendment in 2010, the responsibility of implementing climate change policies rests with respective provinces/subnational governments in the country. The province accounts for 53% of the total GDP in the country. It is noted that agriculture adaptation actions reduce agricultural losses.

Based on Scientific evidence, Khyber Pakhtunkhwa Province is assessed to be one of the most vulnerable provinces of Pakistan to the negative impacts of Climate Change. Since 2010, KP has been facing extreme precipitation events, in the Indus catchment areas, particularly during the annual monsoon season. This results in swelling of rivers, causing localized and major floods in low-lying areas. KP is also facing an increased number of glacial lake outburst floods (GLOF) due to increased temperatures and intense precipitation. Being an upper riparian province in Pakistan, KP receives the shortest lead times for early warnings on climate-induced hydro-meteorological disasters. As a result of the 2010 floods, KP suffered US$ 1.1 billion in damages, which included damages and losses of US$ 96 million1 to the agriculture sector in the province.

Looking into the extreme vulnerability of the province to the negative impacts of Climate Change, the present Government of KP decided the formulate the Provincial Climate Change Policy of the Province. The current Provincial Climate Change Policy (PCCP) of KP is in line with the National Climate Change Policy of Pakistan (2012), but is more specific and focused on the ecosystems of the province. For this purpose, secondary data from all relevant Departments about Climate Change was collected in collaboration with Government Line Departments. The Policy is focused on the challenges of KP and to overcome these challenges, two approaches, i.e. adaptation and mitigation in relevant sectors, are adopted. One of the basic purposes of the formulation of the Provincial Climate Change Policy is to support the national and global efforts against the Climate Change phenomenon.

Climate change may have many impacts on horticultural crops. The established commercial varieties of fruits and vegetables will perform poorly in an unpredictable manner due to the aberration of climate. Melting ice will reduce the chilling effect required for the flowering of many of the temperate horticultural crops like pome, stone and berries, etc. Commercial production of horticultural plants, particularly grown under open field conditions, will be severely affected. Due to high temperature, physiological disorders of horticultural crops will be more pronounced, e.g. spongy tissue of mango, fruit cracking, flower and fruit abscission in fruits and vegetables, etc. Production timing may change due to a temperature rise, and photoperiods may not show much variation.

As a result, photosensitive crops will mature faster. The winter regime and chilling duration will be reduced in temperate regions, affecting the temperate crops. Pollination will be affected adversely because of higher temperatures. The annual irrigation requirement will increase, and the heat unit requirement will be achieved in a much shorter time. Higher temperatures will reduce the tuber initiation process in potato, reduce quality in tomatoes and pollination in many crops. In case of crucifers, it may lead to bolting; anthocyanin production may be affected in apples and capsicum. Tip burn and blossom end rot will be a common phenomenon in tomatoes. Air pollution also significantly decreased the yield of several horticultural crops and increased the intensity of certain physiological disorders. Hence, there is a need to protect these valuable crops for

sustainability against the climate change scenario. The most effective way is to adopt conservation agriculture, using renewable energy, forest and water conservation, reforestation, etc.

To sustain productivity, modification of present horticultural practices and greater use of greenhouse technology are some of the solutions to minimize the effects of climate change. Development of new cultivars of horticultural crops tolerant to high temperature, resistant to pests and diseases, short duration and producing good yield under stress conditions, as well as adoption of hi–tech horticulture and judicious management of natural resources, will be the main strategies to meet this challenge.

The following are some other points to consider concerning climate change as well.

- Great need to invest in training more extension officers on climate change and adaptation strategies, being the primary source of advice for smallholder farmers
- Support research and development towards the implications of climate change on insect pests.
- A mechanism needs to be devised in order to create root-level awareness among the farmers

❖ CURRENT PAKISTAN HORTICULTURE EXPORT STATUS

The fruits and vegetable market in Pakistan is valued at USD 8.0 billion in 2017 and is expected to register a CAGR of 5.6% during 2023. Moreover, to meet the export and consumer demand for fruits and vegetables, the government is planning to invest more in the agricultural sector. (Pakistan Fruits and Vegetables Market - Segmented by Fruits and Vegetables- Growth, Trends, and Forecast (2014 - 2023)

During the financial year 2018-19, Pakistan exported 768,202 metric tons of fruit, worth a total of $416 million. This marks an increase of 4.21% compared with last year's exports, which amounted to 696,648 metric tons, valued at $399.515 million. The data from the Pakistan Bureau of Statistics revealed that exports of vegetables decreased by 2.31%. About 1.029 million metric tons of vegetables were exported during FY 2018-19, worth $234.845 million, compared to exports of 880,848 metric tons valued at $240.400 million during the same period last year.

(https://medium.com/@etradepakistan1/pakistan-exports-fruit-and-vegetable-markets-growth-trends-forecast-58dc8ae4fdc6)

On a month-on-month basis, the exports of the above-mentioned commodities also registered positive growth as fruits exports grew by 0.94% in June 2019 as compared the same month of last year. In June, about 31,110 metric tons of fruit worth $22.164 million were exported as compared to exports of 24,278 metric tons valued at $21.958 million in the same month of last year. The country earned $13.894 million by exporting about 53,229 metric tons of vegetables in June 2019 compared with exports of 49,296 metric tons worth $11.507 million in the same month last year. During the period from July-June 2018-19, food import came down from $6.184 billion to $5.668 billion.

(https://propakistani.pk/2019/08/10/fruit-export-increases-4-21-in-fy-2018-19)

Figure 5: Economic Value of Fruits and Vegetables of Pakistan (Billion US $)

Presently Pakistan is exporting fruits and vegetables to the USA, Europe, Middle East, Far East, India, and Sri Lanka. Apple, Dates, Oranges, and Guava are few well-exported fruits and among vegetables are Potato, Onion, and Garlic, etc. It is observed by looking at the data, Pakistan is heavily relying on one market for each item. For example, Dubai is the biggest market for Pakistani Mango following England and Saudi Arabia. Sri Lanka is the only biggest market for Pakistani fresh Apple. In such a situation, the buyer dictates his terms.

There is a need to explore new markets for Pakistani fruits and vegetables to gain good prices. Ninety-seven percent of fresh Apples are exported to Sri Lanka only. In adverse conditions, there is no other market available for Apple. Exporters must explore new markets to catch up with high prices. A large share of fresh Dates is being exported to the USA (31.16 percent) followed by India (24.76%), Canada (13.3 percent), UK (6.9 percent), Denmark (5.6 percent), Germany (4.7%), and remaining to other parts of the world. Fresh Dates exports are not relying on one market. In other words, we can say that market demand is evenly distributed. Pakistan must explore such markets for other fruits to avoid relying on only a few countries.

(https://www.brecorder.com/2019/08/08/516867/fruits-worth-us-415-978mn-exported-in-fy-2018-19/)

Fresh Dates earned $3.330 million in 99-2000. Whereas, the export of dry Dates is dependent on the Indian market, as 92.6 percent exports of the total exports of dry Dates go to India. Top three countries for Potato exports were Afghanistan, Sri Lanka and UAE in 2017-18. (Export of Fruit, Vegetable, and Condiments Country Wise)

Horticulture, which contributes majorly to the agriculture export sector of Pakistan, is unfortunately much neglected. Citrus, Mangoes, Potatoes, Onion, Apricot, Cherries and Cabbages are the primary export items from Pakistan and are highly recognized all over the world. Since the

low production of internationally favourites fruits like Banana, Apple, Grapes, and Strawberry can hardly meet the demand of the domestic market, export opportunities have squeezed further.

❖ OVERVIEW OF KP AGRICULTURE POLICY

The agriculture sector, including crops, livestock, on-farm water management, and fisheries, in Khyber Pakhtunkhwa, has not performed in line with its potential and there was an urgent need to accelerate the growth of agriculture sector as a prerequisite for improving rural incomes and food security. According to FAO, a new policy was needed because of the many changes in the sector particularly the increased participation of the private sector and NGOs in agriculture, as well as the devolution of additional responsibilities for the agriculture sector under the 18th Constitutional Amendment. Khyber Pakhtunkhwa was the first province to prepare a new agriculture policy following devolution and the experience gained from this process would be useful for enhancing policy coordination at the provincial level.

New agriculture policy (2015-2025) and strategy include a review of previous reports and policies; a vision, goal and longer-term policy directions related to the public, private and NGO/CSO sectors, capacity development and use of land and water resources; a set of specific high priority actions for implementation in the short term; and business plans with well-defined implementation arrangements. The new policy was built on existing policy documents, particularly the "Agricultural Policy, NWFP 2005", the "Horticultural Policy, Khyber Pakhtunkhwa Province, 2009", Khyber Pakhtunkhwa Comprehensive Development Strategy 2010, and the ongoing preparatory work on a new policy for the livestock sector.

Cognizant of its increased responsibilities after 18th constitutional amendment, the provincial government and the Administrative Department of Agriculture, Livestock, and Cooperatives are focused on devising meaningful policies and strategies aimed at promoting synergies and complementarities, based on a pluralistic approach for managing the natural resources base of the province to achieve economic growth. The growth in the agriculture sector also contributes to addressing the multiple economic challenges faced by the province by taking advantage of the unique and diverse agro-climatic conditions of the province which provides great potential for agriculture development. The agriculture policy aims at tapping these opportunities. There are more than twenty different fruits and vegetables grown in the province with enormous growth potential in the development of high-value crops such as horticulture crops and floriculture, as well as the development of livestock sector that includes dairy products and meat.

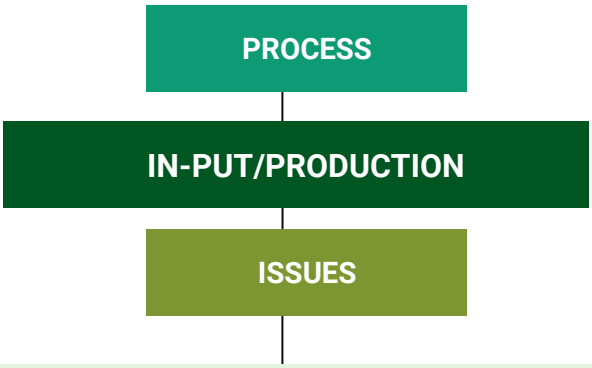
To achieve the vision of food security, poverty reduction, and economic growth, the agriculture policy is focused on increasing provincial government reliance on its resources, improving the Government's capacity in terms of effectiveness and efficiency and future dialogues with donors, and multiplying efforts for resource mobilization with financing agencies. Further, it adopts a shift

in approach from investing in infrastructure to the socio-economic development of the province. To ensure proper implementation, the policy document elaborates on the roles and responsibilities of various stakeholders; focuses on institutional reforms and strengthening; enhancing the department's capacity to respond to climate change and risk reduction, and actions to be taken in short terms to achieve quick and solid results. It also proposes a business Plan for value-added agriculture and strengthens the capacity of the Department of Agriculture, Livestock, and Cooperative. To ensure effective implementation of the policy, the Ministry will set up a governing body that should guide and monitor the implementation of the policy to achieve it's short, medium- and long-term goals.

Now the provincial government is committed to achieve economic growth in the agriculture sector and reduce poverty levels of the province in general and of farmers in specific. The steps taken through a new agriculture policy will be useful in improving the market structure of KP.

KEY RECOMMENDATIONS

FRUIT AND VEGETABLES SECTOR



Lack of producer's access to advance and high-yielding technologies, varieties and planting material and their ability to adopt these technologies.

- Water shortage has become a serious issue which affects productivity in many districts.
- Improper production practices collectively result in poor quality produce.
- Manual and unscientific operation are too in-efficient, thus hindering productivity and quality of fresh fruits and vegetables.
- Inappropriate approach to handle pests and diseases management.
- Establish Farmers Enterprise Groups (FEGs) for collective marketing and bargaining.

RECCOMENDATION

- Capacity building of stakeholders including farmers, traders, processors, etc. on improved production/management practices in the value chain by introducing specialized extension services. The universities, NGOs and national and international consultants should be involved in contacting the stakeholders to be trained, hosting the training, preparing broachers on various aspects and train the trainers.
- Promotion of certified nurseries to supply true-to-type, clean and healthy planting materials for renovations of orchards, provide vegetable seeds, flower and ornamental plants nurseries to the producers.
- Develop and promote cut flower/ornamental plants production as a source of livelihood in rural communities through Introduction of cut flower species / types and different ornamental plants that can better be grown and meet the demand of national and international market in order to get high returns
- Develop and promote Farmers Enterprise Group (FEG's) through social mobilization and networking. These FEGs are essential in collective farming, develop processing infrastructure and ensure quality of output at group level. Further FEGs can collectively seek better markets, share marketing cost and sell at the best possible price.
- Improving the availability of modern variety seed by implementing the seed sector reforms, and involving Farmers Enterprise Groups (FEGs) and processors in seed production.
- Strengthening of Germplasm Units (GPUs) and multiplication blocks at R&D Institutes through collection of indigenous and exotic germplasm to supply plant propagules/ basic seed to the private sector seed companies and FEGs for multiplication.
- Innovative and mechanized farming should be introduced and accessible to farmers on subsidized rates.
- Develop water management infrastructure such as High Efficiency Drip Irrigation, Double furrow/double rings irrigation system, water harvesting structure, command areas developed etc. also minimize excessive water extraction and introduce crop that has low water requirements.
- Pest and diseases should be managed through IPM approaches. Further laws should be formulated on the use and availability of quality pesticides.
- Strengthen and reform the agriculture research system to identify emerging issues and provide solution. Strengthen international collaboration, improving the role of agriculture research in

germplasm and technology import and implement research agenda at provincial level. Conservation of indigenous germplasms of all crops is also the prime need of the day to avoid any possible untoward situations in coming future might arises as monolopies of MNCs in connection of production of hybrid seeds particularly that of horticultural crops.

- Promotion of contract farming through FEGs by providing appropriate regulatory environment.
- Establishment of Project Management Unit (PMU) at secretariat level to implement the agenda and program activities and backstop them at provincial level.

- Poor harvest and post-harvest management practices (sorting, grading, packing etc.)
- Cool chain infrastructure development.
- High pesticide residue.
- Traceability and certification
- Lack of investment on value chain development.
- Poor presentation of Pakistan's produces to attract buyers in importing countries.
- Produce is not demand driven

  (Lake of proper crop zooning).
- Poor value chain development of the certain exportable produce.
- Lack of Market Information System

RECCOMENDATION

- Train and equipped farmers with small scale post-harvest technologies to minimize post-harvest losses in perishables that account for more than 30 percent of the produce.
- Promotion of products for niche markets based on comparative advantage by public-private partnership.
- Linking farmers with markets by strengthening the marketing capacity of FEGs such as establishing the collection centers and pack-houses in rural areas, promoting contract farming and establishing information blogs on various production and marketing aspects.
- Linking traders with international markets by encouraging them to participate in international events related to the commodity such as food exhibition, trade shows, trade fairs, international workshops etc., establishing e-commerce portal and SMS-based training message schemes and organizing traders into associations.
- Proper crop zooning in all fruits and vegetables should be carried out and monitored to ensure demand driven produce.
- Improving the local output markets by encouraging the private sector to establish these markets, incentivizing collection centers and pack houses in rural areas which itself can become rural market centers, establishing small farm-level cold storage and changing other rules that restricts the investment on these markets.
- Develop Market Information System manage with the Directorate of Agriculture Extension to provide up-to-date information on pricing on different commodities on daily basis.
- Awareness campaigns regarding judicious application of pesticides that hinder certain commodity from export and necessary legislation (if required) from the provincial government.
- Introduce and promote innovative packaging material to protect highly perishable commodity from losses during transportation and improve its cosmetic.
- Promote Pakistan products in local and foreign markets.

PROCESS

VALUE ADDITION & PROCESSING

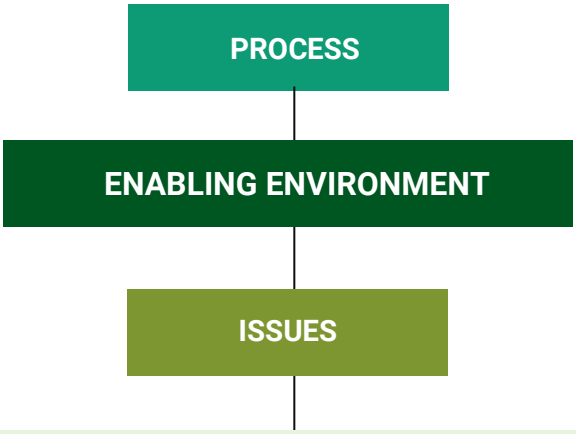
ISSUES

- Promote small scale processing industry through private sector investment and facilitate them in establishing enterprises in growing areas.
- Encourage certification option to maintain hygiene and standard.
- Inefficient commercial policies and strategies for export.
- Weak knowledge and link of the traders with international markets.
- Skill enhancement and human resource development in value addition.
- Poor packing and inappropriate packaging of exportable goods.

RECCOMENDATION

- Incentivizing value addition infrastructures in rural areas such as collection centers, pack houses, farm cold storages. Good value addition practices such as washing, grading, packing etc., will be promoted by providing training on various aspects of value chain management.
- Encouraging small scale processing as cottage industry in rural areas, linking them with big industries in urban centers, providing training to FEGs on hygienic and safety standards and efficient management of these units and encouraging them to certify their processes and brand their products.

- Identify the inefficient operations along the value chain and incentivize their replacement with proper more efficient technologies through private sector investment.



- Public policies are not conducive to work in the agriculture sector.
- Private sector faces many challenges to develop their agri-business in the province.
- Poor security conditions in the province is the major limiting factors in establishing agribusiness and enterprises.
- Poor infrastructure and shortage of electricity is one of the major factors in the province that restrict local enterprises to flourish.

- Plan locally in consultation with stakeholders to address their issues in the local context.
- Change general subsidies with cluster need based support for infrastructure development and capacity building.
- Import substitution by linking import permits with development work done locally.

- Stop frequent interventions in commodity prices to help investors making decisions with certainty.
- Reform the seed sector regulations to promote truth-in-labelling in seed and planting material supplies.
- Forecast local production and need and then allow import/export of horticulture produce to balance supply and demand.
- It will also be desirable to regulate import of fruits and vegetables. For example, the import of apple can be limited to the month, when the domestic peak production season is over.

This policy report has been developed by the **Directorate General of Science & Technology, Government** of Khyber Pakhtunkhwa, as part of the Annual Development Program initiative focused on strategic natural resource development.