YEAR BOOK

2023-24

GOVERNMENT OF PAKISTAN
MINISTRY OF NATIONAL FOOD SECURITY & RESEARCH
ECONOMIC WING
ISLAMABAD

www.mnfsr.gov.pk

YEAR BOOK

2023-24

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RO (EC-II)
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GOVERNEMNT OF PAKISTAN

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Message

Agriculture plays a central role in food security, poverty reduction and economic growth. Its contribution in GDP is 24 percent and 37.4 percent of total labor force of the country is employed in agriculture sector. The agriculture sector witnessed robust growth in 2023-24, with an overall increase of 6.25 percent as well as Food and Agriculture related exports reached record level of $ 8 billion. The past year has presented both challenges and opportunities for Pakistan's agricultural landscape. We have witnessed the resilience of our farmers in the face of climate change impacts, while also celebrating their successes in increasing productivity and diversifying crops.

As we present the Year Book for 2023-24, the Ministry of National Food Security and Research reaffirms its commitment to ensuring food security for all Pakistanis. This publication serves as a comprehensive record of our efforts, achievements, and ongoing initiatives in this vital sector.

Going forward, the Ministry remains dedicated to addressing the evolving challenges to food security in Pakistan. Achieving food security is a collective responsibility. We call upon all stakeholders – farmers, researchers, policymakers, and citizens – to join us in this national endeavor. By working together, we can build a food-secure and prosperous future for Pakistan.

Rana Tanveer Hussain
Minister for National Food Security and Research (NFS&R)

February, 2025

FOREWARD

The **Year Book 2023-24** of the Ministry of National Food Security and Research is an official handbook published in pursuance of sub-rule (2) of Rule 25 of the Rules of Business, 1973, whereby each Ministry is required to prepare a Year Book for information of Cabinet and the general public. The Year Book deliberates activities undertaken by the various Wings of the Ministry, its attached departments and autonomous setup, and accomplishments of the ministry during fiscal year 2023-24 and plan for the next year.

2. I hope this will serve as a useful information resource and reference document for the policy makers, researchers, planners, and general public on matters relating to food and agriculture. I highly appreciate the efforts of officers and staff of Economic Wing, engaged in compiling and printing the year book in time. Comments and suggestions for improvement of the year book would be highly appreciated.

(Mr. Waseem Ajmal Chaudhry)
Secretary
Ministry of National Food Security and Research (NFS&R)

January, 2025

INTRODUCTION

Pakistan is a country with diverse ecological zones, featuring considerable variations in topography, altitude, climate and seasons. This diversity enables the cultivation of a wide range of crops and supports livestock throughout the country. Pakistan's agriculture sector has impressive growth, with agro and food product exports **surpassing $8 billion in the fiscal year 2023-24** from $ 5.8 billion, a **37% increase** compared to the previous year. This remarkable surge underscores the sector's growing significance in the global market. This increases the growing importance of Pakistan's agriculture sector in the global market and the revolutionary initiatives of Special Investment Facilitation Council (SIFC).

The agriculture sector serves as the backbone of Pakistan's economy and **provides the inputs to Pakistan's economy**. Although the country has developed in the manufacturing and services sectors, agriculture still remains one of the most significant components of the country's economic scenario. Agriculture productivity is highly sensitive to the frequency of adverse sector climatic events like flood and drought along with abnormal heat waves, rains and glacial melt. Livestock presents a plethora of untapped opportunities for entrepreneurs and investors. With a population exceeding 241.5 million, livestock contributes 14.63 percent to the national GDP and has more than 60.84% share in the agriculture sector. It continued to perform well and contributed more than half of growth in agriculture value addition.

The main challenge lies in water management. Currently, the normal flow of Indus Basin has plummeted to 40%, which is primarily due to climate change. Pakistan's irrigation system loses water it draws from the Indus River Basin through inefficient practices like flood irrigation on farms. Corporate farming offers a solution by implementing advanced irrigation technologies and efficient water management practices through its collaborative nature and appetite. By reducing water wastage and optimizing production costs, corporate farming can significantly enhance agricultural productivity and sustainability, demonstrating the true business potential of agriculture. Agriculture growth underscores the government's commitment to supporting the farmers' financial needs, fostering greater investment in the sector, and enhancing agricultural productivity. The rise in credit disbursement is a crucial factor in enabling farmers to access modern equipment, quality seeds, and necessary inputs.

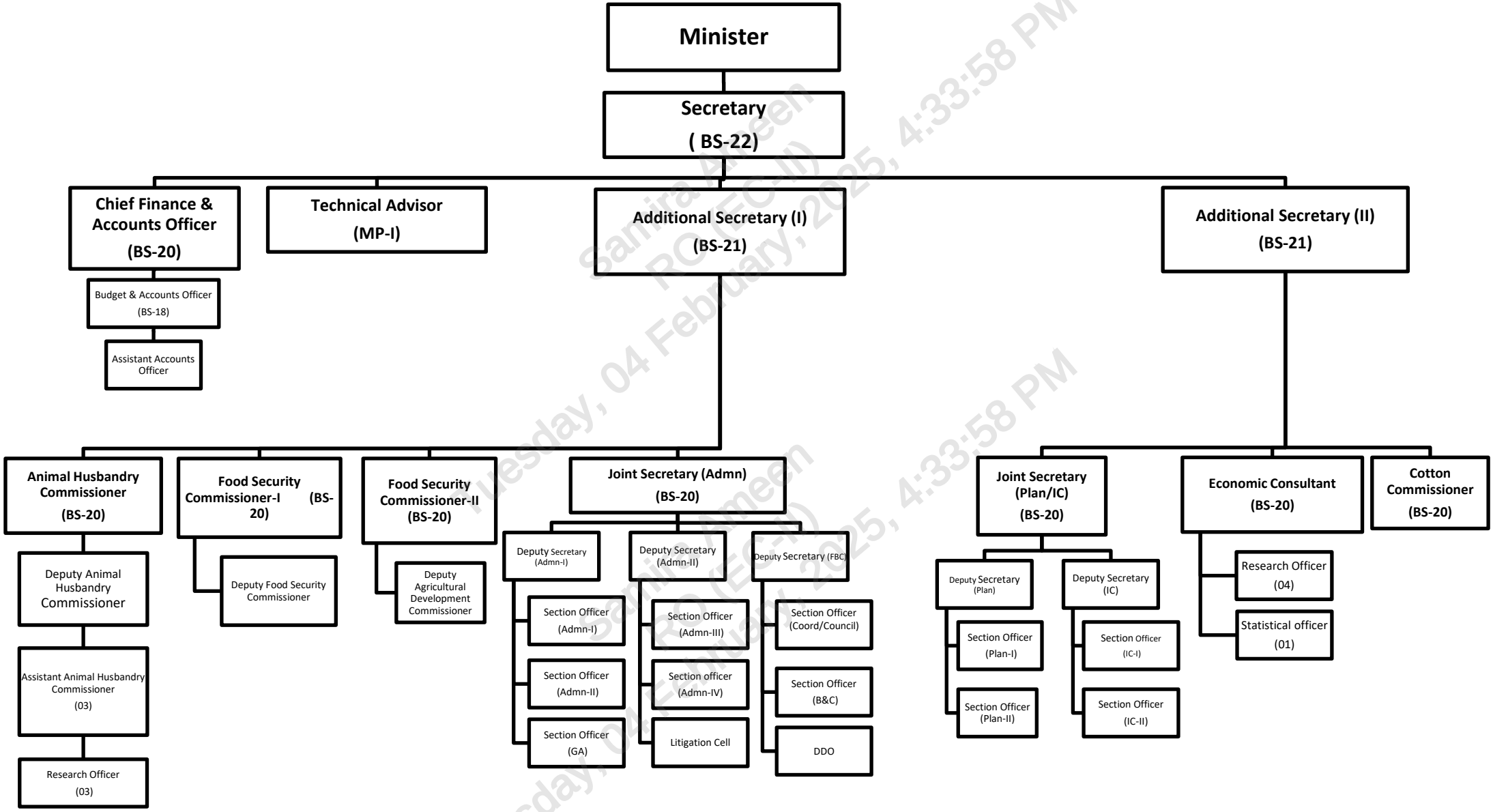
Despite challenges in the agriculture sector, the government remains optimistic about achieving its production targets. Efforts have been made to ensure the timely availability of crucial inputs, such as improved seeds, fertilizers, and adequate agricultural credit, to support the farmers in overcoming these hurdles. There may be serious attempts to introduce efficiently adapted high-yielding breeding crops with proper implementation of PSDP for progress of the agriculture industry quotient in the country. Commitment to innovation, seed research and development, corporate farming, and high-value crops demonstrates its potential to transform Pakistan's agriculture sector. By leveraging research and development, optimizing resource use, and advocating for supportive policies, the company aims to address food security challenges, boost exports, and drive economic growth.

OVERVIEW

The Ministry of National Food Security and Research (NFS&R) through its attached departments, autonomous organizations and boards is focusing to ensure food security. Links between agriculture and food security have long been recognized and there are major shifts in understanding that have led to recognition that agriculture is one of the main contributor to food security. The M/o NFS&R since its inception, have been aiming to improve, coordinate and strengthening agricultural research and development activities in the country.

Functions of M/o NFS&R under Rules of Business, 1973

1. Economic Coordination and Planning in respect of Food, Economic Planning and Policy making in respect of agriculture.
2. Imports and exports control on food grains and foodstuffs, inspection, grading analysis of food grains and foodstuffs, maintenance of standards of quality for import and export and inspection, handling, storage and shipment of rice exports.
3. Collection of statistics regarding production, consumption, prices, imports and exports of food grains.
4. Coordination with aid and assistance agencies in respect of food sector.
5. Pakistan Agricultural Research Council and other Federal agriculture research organizations.
6. Food and Agriculture Organization (FAO) of United Nations in respect of food.
7. Plant Protection, Pesticide import and standardization, Aerial Spray, Plant Quarantine and Locust control in its international aspect and maintenance of locusts warning organizations.
8. Federal Seed Certification and Registration.
9. Standardization and import of fertilizer.
10. Procurement of food grains, including sugar
    i. from abroad;
    ii. for Federal requirement;
    iii. for inter-provincial supplies; and
    iv. for export and storage at ports.
11. Grading of agricultural commodities, other than food grains, for exports.
12. Administrative control of PASSCO.
13. Preparation of basic plan for bulk allocation of food grains and foodstuffs.
14. Price stabilization by fixing procurement and issue prices including keeping a watch over the price of food grains and foodstuffs imported from abroad or required for export and those required for inter-provincial supplies.
15. Agricultural Policy Institute.
16. Animal Quarantine Departments, stations and facilities located anywhere in Pakistan.
17. National Veterinary Laboratory, Islamabad.
18. Laboratory for Detection of Drugs Residues in Animal Products at Karachi.
19. Veterinary drugs, vaccines and animal feed additives.
20. Import and export; and
21. Procurement from abroad for Federal requirements and for inter-provincial supplies.
22. Livestock, poultry and livestock products;
23. Import and export; and
24. Laying down national grades.
25. Livestock and Dairy Development Board (LDDB).
26. Fisheries Development Board (FDB).
27. Pakistan Oilseed Development Board (PODB) (for federal areas only).
28. International cooperation matters relating to agriculture and livestock.
29. Administrative control of the Agricultural Counselor's Office at Rome, Italy.



1. ADMINISTRATION WING

Admin Wing headed by Joint Secretary (Admn)	**D.S (Admn-I)**	Supervision of work of Admn-I, Admn-II and GA Sections.
	S.O (Admn-I)	All administrative matters of main Ministry, AQD, NVL and FWMC.
	S.O (Admn-II)	All administrative matters of DPP, FSC&RD and PBRR.
	S.O (GA)	All matters relating to general administration of the Ministry.
	D.S (Admn-II) previously DS (FS)	Supervision of work of Admn-III & Admn-IV Sections and Litigation Cell.
	S.O (Admn-III)	All administrative matters of PARC, PCCC, PCSI, POD and NFDC.
	S.O (Admn-IV) previously SO (FS)	All administrative matters of API, PASSCO, PTB, LDDB and FDB.
	Litigation Cell	All litigation matters of main Ministry and departments/organizations where Ministry is respondent or petitioner.
	D.S (FBC)	Supervision of work of B&C and Council/Coord Sections.
	S.O (Council/Coord)	All matters relating to Parliamentary Business and those requiring coordination within Ministry and departments/ organizations.
	S.O (B&C)	All financial/budgetary matters of main Ministry and departments/organizations.
	DDO	Preparation and submission of bills and reconciliation of funds with the AGPR.
Plan/IC Wing headed by Joint Secretary Plan/IC)	**D.S (IC)**	Supervision of work of IC-I and IC-II Sections.
	SO (IC-I)	All International Cooperation matters of non-Muslim countries and UNO/allied agencies/organizations.
	SO (IC-II)	All International Cooperation matters of Muslim countries and OIC and other respective development agencies/ organizations.
	D.S (Plan)	Supervision of work of Plan Section.
	SO (Plan)1	• All PSDP matters of main Ministry and attached departments/organizations. Policy matters pertaining to Development side including preparation of PC-IIs, surveys or analysis • All matter related to PSDP (preparation of PC-Is, approvals by DDWP/CDW/ ECNEC, implementation through departments, monitoring through M&E Cell etc) • All matters related to foreign funded projects including grants, TCPs etc • DDWP secretariat Administrative section for all project employees • Coordinating activities pertaining to National Coordination Committee (NCC) on Agriculture

	SO (Plan)2	Transformation Plan (ATP) • Processing of matters regarding PSDP+ Initiative • Court cases including cases of regularization • All matters related to liabilities of closed/developed projects Processing of PC-IV and PC-V after closure of the projects.

Technical Wing	**Commissioner Minor Crops / Food Security Commissioner-I**	FSC-I along with officer(s) under his supervision will deal with all technical matters as per job description besides technical matters of FWMC, DPP, POD, PARC and PTB.
	Wheat Commissioner / Food Security Commissioner-II	FSC-II along with officer(s) under his supervision will deal with all technical matters as per job description besides technical matters of FSC&RD, PBRR, API and PASSCO.
	Cotton Commissioner	Cotton Commissioner will deal with all technical matters pertaining to cotton crop besides technical matters of PCCC and PCSI.
	Chief, NFDC	Chief, NFDC along with officer under his supervision will deal with all technical matters pertaining to fertilizer besides administrative matters within NFDC.
Livestock Wing	**Animal Husbandry Commissioner**	AHC along with officer(s) under his supervision will deal with all technical matters pertaining to livestock sector besides technical matters of AQD, NVL, LDDB and FDB.
Economic Wing	**Economic Consultant**	Economic Consultant along with officer(s) under his supervision will deal with all matters of economic coordination and planning besides other tasks assigned to him from time to time.

DEPARTMENTS / ORGANIZATIONS ETC. OF
MINISTRY OF NATIONAL FOOD SECURITY AND RESEARCH

Technical Section

1. National Fertilizer Development Centre (NFDC), Islamabad

Subordinate Offices

1. Federal Water Management Cell (FWMC), Islamabad
2. National Veterinary Laboratory (NVL), Islamabad

Attached Departments

1. Animal Quarantine Department (AQD), Karachi
2. Department of Plant Protection (DPP), Karachi
3. Federal Seed Certification and Registration Department (FSC&RD), Islamabad
4. Plant Breeders Rights Registry (PBRR), Islamabad
5. Pakistan Oilseed Department (POD), Islamabad

6. Agriculture Policy Institute (API), Islamabad

Autonomous Bodies / Corporations

1. Pakistan Agriculture Research Council (PARC), Islamabad
2. Pakistan Central Cotton Committee (PCCC), Multan
3. Pakistan Cotton Standard Institute (PCSI), Multan
4. Pakistan Agriculture Storage & Services Corporation (PASSCO), Lahore

Companies / Board

1. Livestock and Dairy Development Board (LDDB), Islamabad
2. Fisheries Development Board (FDB), Islamabad
3. Pakistan Tobacco Board (PTB), Peshawar

2. PLAN WING

The Plan Wing of Ministry of National Food Security and Research is responsible to coordinate with developmental activities with regard to Food Security through Public Sector Development Programme (PSDP). This Wing analyses the project proposals/PC-I's initiated by the line Departments of the Ministry and processes those for approval of the competent forums such as DDWP, CDWP and ECNEC etc. as the case may be. Not only it releases the funds on quarterly basis after obtaining approval from the relevant quarters but it is also responsible for monitoring and evaluation of the development projects and Policy matters pertaining to Development projects.

Funds to the tune of Rs.8850.000 million were allocated in PSDP 2023-24 for execution of the following development projects under this Ministry: -

Sr. No	Project Name
01.	Better Cotton Initiatives (BCI) For Sustainable Cotton Production in Pakistan
02.	Cage Culture Cluster Development Project
03.	Commercialization of Potato Tissue Culture Technology
04.	Establishment of Consumer-Sourcing Seed Authenticity System & Strengthening of Labs of FSC&RD
05.	Establishment of Plant Breeders Right Registry and Strengthening of DUS Examination System
06.	Establishment of Seed Certification Laboratory in Khuzdar &Turbat
07.	National Oilseed Enhancement Program
08.	National Peste des Petits Ruminants (PPR) Eradication Programme: Phase 1 - Risk Based PPR Control in Sheep and Goats of Pakistan
09.	National Program for Enhancing Command Area in Barani Areas of Pakistan
10.	National Program for Improvement of Water Courses in Pakistan Phase-II
11.	Pilot Shrimp Farming Cluster Development Project
12.	Productivity Enhancement of Rice
13.	Productivity Enhancement of Sugarcane
14.	Productivity Enhancement in Wheat
15.	Promotion Research for Productivity Enhancement in Pulses
16.	Promotion of Olive Cultivation on Commercial Scale in Pakistan Phase-II

17.	Promotion of Trout Farming in Northern Areas of Pakistan
18.	Sino-Pak Agriculture Breeding Innovations Project for Rapid Yield Enhancement
19.	Water Conservation in Barani Areas of Khyber Pakhtunkhwa
20.	Locust Emergency and Food Security
21.	Mainstreaming of Mountain Agriculture Research Centre (MARC) for the Promotion of High Value Agriculture in Gilgit-Baltistan
22.	Pakistan-Korea Joint Program on Certified Seed Potato Production System
23.	Professional Capacity Building and Extension in Agriculture (TEVT National Reform Program)
24.	Horticulture Support Program

3. ECONOMIC WING

Economic Wing is a technical arm of this Ministry in terms of its responsibility for maintenance of data bank through imperative annual publications and provision of analytical support in the capacity of economic, trade and investment related issues of the food sector. The Wing collects information regarding Crop Area, Production and other Food Statistics from Federal and Provincial Governments, Pakistan Bureau of Statistics and other departments/agencies, and thereafter performs the function of its compilation, computerization and dissemination in the form of Publications on annual basis.

The Wing is also responsible for issuance of final estimates of about 54 major and minor crops at national and international level. Following two functions under Rules of Business empower Economic Wing: -

- Collection of statistics regarding production, consumption, prices, and imports and exports of grains (Fully)
- Economic Coordination and Planning in respect of food, economic planning and policy making in respect of agriculture (Partially)

Economic Wing published following books during the period under review:-

Agricultural Statistics of Pakistan 2022-23

The Wing released and uploaded the publication on Ministry's website. The next publication is in process The publication covers:

- Area, production and yield of major and minor crops including cereals, pulses, oilseeds, condiments, fodder, fruits and vegetables.
- Land use statistics
- Use of inputs
- Agricultural credit
- Agricultural mechanization
- Livestock, fisheries and forestry statistics
- Trade statistics
- Prices of agricultural commodities
- Miscellaneous statistics
- Conversion factors

Fruit, Vegetables & Condiments Statistics of Pakistan 2022-23

The Wing released and uploaded the publication on Ministry's website "Fruit, Vegetables and Condiments Statistics of Pakistan 2022-23" containing province-wise data for the year 2018-19 to 2022-23. It also contains data on exports, imports (by destination) and wholesale prices which provide updated information for researchers, government functionaries, exporters and all those interested in the issues concerning the agriculture sector. The next publication is in process.

Crops Area and Production (By Districts) 2022-23

Economic Wing released and uploaded the publication titled "Area and Production (By Districts)" on Ministry's website . This publication contained latest district-wise data on major/minor crops including condiments, fruit and vegetables. The next publication is in process.

Year Book of the Ministry 2022-23

In pursuance of Rule 25(2) of the Rules of Business, 1973, the Economic Wing published Year Book, containing details of activities and achievements of M/o NFS&R, its attached departments and autonomous bodies. The material was collected from all Wings, Departments and Autonomous bodies under the administrative control of M/o NFS&R. This publication has also been uploaded on ministry's website as well.

In addition to the above publications, this section was also involved in the following activities.

- Data supplied to IMF, FAO and Prime Minister's Secretariat including other national / international agencies and NGOs.
- Released Kharif and Rabi estimates of crops at national level for circulation among Federal and Provincial Government Departments/ Autonomous bodies.
- Prepared briefs on prices of Food/Agricultural Commodities for the Secretary, M/o NFS&R.
- Replies of various National Assembly/Senate Questions were prepared.
- Representining MNFS&R at National Price Monitoring Committee and presenting supply and Price situation of food commodities.

Performance of Essential Agriculture Food Commodities (EAFC) Cell

I. Essential Agricultural Food Commodities (EAFC) Monitoring Cell

Background

The Honorable Prime Minister in the meeting of Price Control held on 6thNovember 2019 directed to establish a cell to analyze and anticipate commodity supply and pricing trend . For implementation, the worthy minister NFS&R and Secretary NFS&R had granted approval for establishment of "Essential Agricultural Food Commodities (EAFC) Price Monitoring Cell. The objectives of EAFC Monitoring Cell is based on the American model of Production Estimates and Crop Assessment Program (PECAP) which is primary objectives of grant of Endowment Fund to the M/o NFS&R under "Agreement between USA and Islamic Republic of Pakistan" Recipient Agency Agreement between MINFAL(Economic Wing) of GoP and US Department of Agriculture of USA, and Rules and Regulations of Endowment Fund.

Functions

1. Monitoring of Area, production, prices, demand, import, export, stocks and area cultivated of 15 Essential Food Commodities
2. Reports on daily, weekly & monthly basis on these commodities
3. Consumption patterns identifying supply-demand gaps
4. Production forecasts and assessments of the stocks for food security
5. Updates on domestic and international stocks positions
6. Global supply-demand estimates, market outlook
7. Reporting on the WTO notifications and other key questions to the national assembly
8. Working in a close liaison to the Food security commissioners and Technical advisor of the MNFS&R on critical issues of the food security
9. Cost benefits analysis.

Addition to the above the EAFC cell of the Economic Wing is providing policy feedback and generating reports on supply, prices and stocks, area cultivated and production of the essential food commodities on daily, weekly and monthly basis. The reports are shared with all the stakeholders mainly, PM office, the Finance Division, Planning Division and all other concerned departments. The EAFC since its birth is dedicated to the Following tasks:

1) Collection of the data of the essential food commodities, maintaining/updating the records of the crop estimates obtained from the provinces.
2) Performing data cleaning, data analysis to draw insights from the data obtained from provinces and other departments.
3) Identification of the demand and supply gaps of the food commodities and provide policy feedback to the MNFS&R and other related departments.
4) Monitoring of price trends, demand, import, export, stocks and area cultivated of 15 Essential Food Commodities.
5) Coordination with province to ensure data validity and availability for policy feedback and intervention.
6) Daily reports on wheat stocks & sugar at national and provincial level are being generated by EAFC cell shared with PM Office and other stake holders for policy feedback.
7) Weekly and monthly reports on prices of essential commodity are being generated by the EAFC cell and potential supply and demand gaps identified and reported to the allied departments.
8) Cost benefit analysis of different government policies like Cotton, Wheat and pulses procurement to control prices.
9) Weekly and daily briefs are being prepared by the EAFC cell for Minister and Secretary MNFSR.
10) Monitoring dashboard on daily basis to ensure the data validation and frequency.
11) Suggestions/feedback to Economic Consultant/Secretary on front end development of dashboard and improvements of Graphic User Interface (GUI).
12) The monitoring officers have departed six training sessions to the provincial and federal departments on “how to upload the data, and how to utilize the portal for policy analysis?
13) The EAFC cell is working on the further development of the portal.

II. Food Security Dashboard

To cater to the emerging needs of an hour, FSP (Food Security Portal) was established in Ministry of National Food Security & Research (MNFS&R) on Prime Minister's initiative. The Food Security Dashboard is established in compliance with the Prime Minister's directive. It aims to monitor supply, demand and prices of essential agricultural food commodities, seasonal availability of these commodities at a high frequency level and provide policy feed back to the Ministry of National Food Security & Research for timely intervention. The objective of FSD is to bring the agriculture and food security data at a very high frequency for evidence based policy planning and decision-making. This will help to achieve the objectives of reducing food insecurity included in the 12th Five Year Plan and National Food Security Policy adopted by the Government of Pakistan.

Objectives of Food Security Dashboard

The primary objective of FSP to mainly provide high frequency data and digitize on following aspect of National Food Security, for timely & effective policy intervention:

1. Agri-production (area, yield, and production) of agricultural commodities.
2. Agri-inputs (seeds, fertilizers, pesticides, herbicides, fuel etc.) prices, domestic sales, imports, export.
3. Food consumption patterns and demand analysis.
4. Food Security(volume, rationale, storage type and efficiency of food stocks by Federal and Provincial governments).
5. Detailed forecast on the unforeseen situations including the pest attacks and unfavorable weather conditions.
6. Market trends of both domestic and outlook of the essential food commodities
7. Linkages with different data sources to promote research on food security and agriculture food crops.
8. Support for planning and policy making process of the Federal Ministry of Food Security and Research.
9. Data bases and DBMS to handle, manage, process and report data relevant to the process of agricultural planning and coordinating and facilitating the exchange of information among the producers and users of the agriculture data
10. Report wholesale & retail prices of essential agricultural food commodities and generate early price alerts for timely intervention by the government.
11. Seasonal availability of essential agricultural food commodities and suggest timely intervention.
12. Balance sheet of essential agricultural food commodities
13. Assessing the impact of policies, programs and modeling food security outcomes.

In addition to the functions contained in the EAFC & Dashboard, the Economic wing is also developing a digital data bank starting from 1947 using the given capabilities and manpower with the collaboration of the Asian Development Bank. This data bank will serve as the country's first ever digital platform for the agricultural data which will be available for the publicand for the decision support system to the relevant stake holders. This is built solely on the international food security standards and best practices.

Training on National Food Security Portal (FSP)

To align the provincial departments with the national standards of data, various Series of trainings sessions were conducted on the Food Security Portal (FSP) in Pakistan. The training targeted Food Departments, Crop reporting Services (CRS) and Cane Commissioner of four Provinces, namely Sindh, Khyber Pakhtunkhwa (KP), Punjab, and Balochistan, along with the participation of the Pakistan Agricultural Storage & Services Corporation (PASSCO), Agriculture Marketing Information Service (AMIS) Punjab, Provincial agriculture department and staff of the Economic wing of Ministry of National Food Security & Research. Objectives of trainings were to:

1. Familiarize participants with the features and functionalities of the Food Security portal.
2. Enable participants to navigate and utilize the portal for data analysis and reporting.
3. Enhance participants' understanding of food security concepts, indicators, and monitoring mechanisms.
4. Promote collaboration and information sharing among participants to improve food security practices.
5. Develop a comprehensive action plan for each province and PASSCO to address data authenticity and accuracy challenges.

Current Status of FSD

Ministry of National Food Security & Research has operationalized food security portal from 9th June 2021. Dashboard for wheat, sugar, vegetables, and pulses were completed in Food Security dashboard fully operational.Dashboad on price analysis has been added to FSP and Module of Trade Analysis is under development.

Legal Support:

To ensure data support by the Provinces ***"Pakistan Food Security Flow of Information Ordinance, 2021"*** has been promulgated by the President of Islamic Republic of Pakistan. The ordinance comprehensively illuminates the importance of digitalization of Food Security data and legally bound the provincial authorities to provide the required data for the Food Security Portal and coordinate with Economic Wing of M/o NFS&R.

4. FOOD SECURITY COMMISSIONERS

(TECHNICAL WING FOOD SECURITY COMMISSIONER – I)

The office of FSC-I is part of technical wing of M/o NFS&R and have following functions:

1. Professional and technical inputs in the formulation of policies and action programs for high value food crops to ensure food security.
2. Policy advice on various issues pertaining to production, price trends marketing and international trade of high value crops.
3. Maintain coordination and liaison with agricultural research institutes and extension services at Federal and Provincial level with a focus on national food security particularly in relation to high value crops.
4. Formulation of development strategy pertaining to high value food crops in order to ensure their availability and accessibility in the country.
5. Scrutinize and evaluate the development schemes/programs being executed by the Federal and Provincial Governments concerning high value food crops.
6. All technical, parliament and court cases pertaining to technical matters of PARC, DPP, FWMC, PTB and POD.

Key Performances

1. Meetings of Federal Committee on Agriculture (FCA) for Rabi 2023 and Kharif 2024 were convened in time to harness the opportunity created for better productivity of different crops. Record production of Wheat, Rice, Cotton, Maize, Onion, Tomato, Mash, Mung and Chilies was obtained during 2023-24.
2. Number of Meetings of Agriculture Pesticide Advisory Committee (APTAC) and Sub APTAC were convened and a number of issues were resolved.
3. Amended Agricultural Pesticide Rules 1973 to import/formulate Bio-pesticides to enhance the production of crops with minimum reliance on chemicals.
4. Made amendments in Pakistan Plant Quarantine Rules, 2019 for ease of doing business.
5. Introduction of Draft Bill for establishing "the Cannabis Control and Regulatory Authority Ordinance, 2024" to regulate the cultivation of Cannabis plant, extraction, refining, manufacturing and sale of derivatives of the plant for medical and industrial use in the country and export for earning foreign exchange.
6. Succeeded to gain market access for exporting Citrus to Mongolia and as such exports materialized.
7. Succeeded to gain market access for exporting Sesame, Cherries, and Dry Chilies to China and as such exports materialized.
8. Formulation of rules in collaboration with the Aviation Division to govern the use of drones in agriculture, which will allow private sector to offer their services using artificial intelligence-based technology.
9. Fixation of the minimum indicative prices of tobacco 63% higher than last year to safeguard the farmer's interest.
10. Exports of onions & bananas was temporarily stopped to stable local market prices during Ramazan-ul-Mubarik.
11. Initiated issuance of Phyto certificates electronically through Pakistan Single Window (PSW)
12. Replies to all the relevant writ petitions filed in different courts were got vetted from Law & Justice Division.
13. Effective supervision of POD, FWMC, PARC, PTB and DPP in all technical matters.
14. During the year more than 60 Assembly and Senate Starred, Un-Starred, Motions and Briefs were furnished by the Technical Wing

FOOD SECURITY COMMISSIONER –II

FSC-II Wing deals with main issue of wheat crop and its production and other issues: -

Importance:

Wheat is the staple crop and it ensures food security of the country. During 2023-24 wheat was cultivated on 9,741 thousand hectares against last year area of 8,977 thousand hectares recorded increase of 7.84%. Wheat contributes 8.2 percent value added in agriculture and 1.9 percent to GDP. The production of wheat stood at 31.81 million tons compared to 28.16 million tons last year, a growth of 12.96% was observed in wheat production. Wheat production increased as Government has announced minimum support price (MSP) to Rs. 3900/40 kg ensuring better economic returns to mitigate higher input cost. Self-sufficiency in wheat has been an objective of every Government and thus always challenges for the agriculture experts and policy makers to meet 80% of the dietary needs with 38% share in calorie intake.

Support Price Mechanism:

As per Rules of Business, 1973 price stability, through demand and supply mechanism, is the main domain of the Ministry of National Food Security and Research. After the implementation of 18th Amendments of the Constitution, 1973, contact with the provinces is an integral part of the consultation. Federal Government only announces the minimum support price (MSP) of wheat, in consultation with provinces. For ensuring Food Security and sustainability in wheat production, support price play an important role. MSP also plays a pivotal role in the rural economy.

Last year, on the recommendations of MNFS&R, the Federal Cabinet in its meeting held on 20-12-2023, fixed profitable support price of wheat crop 2023-24 at Rs.3,900/40 kg. In order to gain maximum benefits, the support price of wheat may be fixed before its sowing season started from 15th November. Wheat MSP during last 15 years is given below:

Production Year	Support Price (Rs. /- 40 Kg)
2009-10	950
2010-11	950
2011-12	1050
2012-13	1200
2013-14	1200
2014-15	1300
2015-16	1300
2016-17	1300
2017-18	1300
2018-19	1300
2019-20	1400
2020-21	1800
2021-22	2200
2022-23	3900
2023-24	3900

Sindh and Balochistan have announced a unilateral support price of wheat at Rs. 4,000/40 kg and Rs.4,300/40 kg for 2023-24 crop respectively.

Benefits of Support Price:

1. Profitability for growers, so that growers do not switch to other alternative crops.
2. Take care of food security in the country.
3. To achieve targets fixed for public wheat procurement.
4. Maintaining strategic reserves in the country.
5. Reduction of import bill and saving of foreign exchange reserves.
6. A considerable amount is injected into the rural economy.

Production 2023-24:

High Powered Federal Committee on Agriculture (FCA) in its meeting held on 31st October, 2023 fixed wheat production target at the tune of 32.12 million tons from an area of 8.997 million hectares as given below:

Province / Crop	Targets proposed by FCA 2022-23		
	Area (000 ha)	Production (000 MT)	Yield (Kg/ha)
Wheat			
Punjab	6475	25000	3861
Sindh	1199	4000	3336
Khyber Pakhtunkhwa	781	1600	2049
Balochistan	542	1520	2804
Pakistan	**8997**	**32120**	**3570**

PRODUCTION V/S ACHIEVEMENTS FOR WHEAT CROP 2023-24

Province / Crop	Targets proposed by FCA 2023-24		Target Achieved 2023-24	
	Area (000 HEC)	Production (000 MMT)	Area (000 HEC)	Production (MMT)
Punjab	6475	25000	7057	24.24
Sindh	1199	4000	1380	4.59
Khyber Pakhtunkhwa	781	1600	773	1.49
Balochistan	542	1520	530	1.49
Pakistan	**8997**	**32120**	**9740**	**31.81**

Source: Provincial Crop Reporting Services (CRS).

Wheat availability for 2023-24:

Overall availability of wheat is estimated at the level of 36.06 MMT, including carry-forward stock of 4.25 MMT and production of 31.81 MMT as compared to the national requirement of 32.94 MMT. Details are given below:

Production (MMT)	Carry-forward Stocks (MMT)	Availability (MMT)	Requirement (MMT)	Estimated Surplus (MMT)
31.81	4.25	36.06	32.94*	3.12

Based on PBS 7th population Census 2023, notified on 05-08-2023 in the 50th meeting of the Council of Common Interests.

Source: CRS, PASSCO, Provincial Food Departments and PBS.

ANNUAL WHEAT CONSUMPTION 2023-24

Province	Population*	Requirement (MMT)
Punjab	130,881,145	15.05
Sindh	57,088,551	6.57
Khyber Pakhtunkhwa	41,877,499	4.82
Balochistan	15,266,762	1.76
Islamabad	2,422,960	0.28
AJK	5,006,232	0.58
GB	1,768,159	0.20
IDP's	1,597,734	0.18
Human consumption**	**255,909,042**	**29.44**
Seed, Feed and Wastages ***	-	1.50
Strategic reserves	-	2.00
Grand Total		**32.94**

*Based on PBS 7th Population Census 2023, notified on 05-05-2023 in the 50th meeting of the Council of Common Interests. **Human consumption is estimated @115 kg/person/annum i.e.; average of HIES 92 Kg and Food Basket of Planning Division @124 kg/person/annum). *** Including seed requirement of 1.2 MMT and poultry feed/wastage @0.3 MMT. **Source:** PBS, CRS, Planning Division, MNFS&R and FSC&RD.

Imports of Milling Wheat:

Since last 4 years, the country is deficit in the wheat availability as compared to its requirement at the national level. Therefore, milling wheat is imported to resolve the issue of food security in the country as per details given below:

Year	Import of Wheat (MMT)			Remarks
	Public	Private	Total	
2020-21	2.160	1.449	3.609	0.465 MMT thorough PASSCO under G2G arrangements.
2021-22	2.201	0	2.201	TCP, through international trending process.
2022-23	2.600	0	2.600	Through TCP, 0.750 under G2G arrangements
2023-24	0	3.59	3.59	Through Private sector

Source: TCP and DPP

In order to mitigate the net shortfall of milling wheat in the country and to stabilize local wheat prices, MNFS&R moved a summary to the ECC of the Cabinet on 10-10-2023 with the following recommendations:

"a) To ensure strategic reserves for the country, formal approval be accorded for import of 1.00 MMT of wheat through TCP for PASSCO under G2G arrangements or through open tendering process, whichever is the lowest and cost efficient in a staggering manner.

b) Private sector will be encouraged to import specified milling wheat under Notification of MinFA dated 14th November 2008 and meeting the criteria envisaged in the Import Policy order 2022.

The ECC of the Cabinet approved the above Summary on 23rd October, 2023.

PASSCO has reported carry forward wheat stock at the level of 1.266 MMT as on 01-04-2024. New procurement of 1.785 MMT in 2024 by PASSCO.

WHEAT STOCK POSITION WITH PASSCO AS ON 22-10-2024

ITEM	Wheat stock (MT)
AVAILABILITY	
Carry-forward stock 2023	1,266,926
Procurement 2024	1,785,037
Total availability	**3,051,963**
Stock Released so far as on 15-08-2023	356,869
Stock to be released	1,041,131
Total Releases up to 01-04-2025	**1,398,000**
Expected Carry-forward Stock as on 01-04-2024	**1,653,963**

WHEAT ALLOCATION AMONG RECIPIENTS FOR 2024-25

S. No.	Recipient Agency/Province/Area	Proposed Allocation (MT)
01.	Pak Army	175,000
02.	Pak Air Force	10,500
03.	Pak Navy	2,500
04.	Khyber Pakhtunkhwa	300,000
05.	Gilgit Baltistan	160,000
06.	Azad Jammu & Kashmir (AJ&K)	300,000
07.	Utility Stores Corporation	450,000
	Grand Total:	**1,398,000***

Allocation summary has been submitted to the ECC of the Cabinet for approval on 11-10-2024 and meeting of the ECC is awaited.

Pakistan Bureau of statics (PBS) on 17-10-2024 has reported wheat flour price at Rs. 1833.33/20 Kg bag, whereas, wheat prices are reported at Rs. 3,133.33/40 Kg. International Grains Council on 18-10-2024 has reported price of Black Sea wheat at US$ 249/MT (FOB). With addition of freight charges of US$ 80/MT and 6% withholding Tax (US$ 15/MT) and US dollar exchange rate @ Rs.280/USD landed cost will of Rs. 3,450/40 Kg or Rs. 86,250/MT at Karachi and Rs.3756/40 kgs or Rs.93900/40 kgs at Lahore.

6. LIVESTOCK WING

LIVESTOCK AND POULTRY

Animal husbandry stands as a cornerstone of the rural economy in Pakistan, with more than 8 million rural families deeply engaged in livestock production. This sector serves as a vital lifeline for these families, contributing significantly to their livelihoods by accounting for around 35-40 percent of their total income. In the broader economic landscape, the livestock sector has solidified its position as the primary driver of agricultural growth, comprising approximately 61.89% of the agriculture value added and 14.04% of the national GDP during the fiscal year 2022-23.

2. The gross value addition of the livestock sector has shown an increase, rising from Rs. 5,388 billion in the fiscal year 2021-22 to Rs. 5,587 billion in 2022-23, marking a growth rate of 3.7%. Moreover, the sector's net foreign exchange earnings make a meaningful contribution, accounting for approximately 1.6% of the total exports in the country.

3. The government has recognized the inherent potential of this sector for economic growth, food security, and poverty alleviation in the country, and has accordingly focused on its development. The overall strategy for livestock development revolves around promoting "private sector-led development with public sector providing enabling environment through policy interventions". Regulatory measures have been implemented to enhance per unit animal productivity by improving veterinary health coverage, husbandry practices, animal breeding practices, assisted reproductive techniques (Embro Transfer Technique, In Virto Fertilization etc.), artificial insemination services, use of balanced ration for animal feeding, and controlling livestock diseases of trade and economic importance, such as FMDE, PPR, LSD and Avian Influenza.

4. The primary objective is to leverage the potential of the livestock sector for economic growth, food security, and rural socioeconomic uplift. To address investment-related issues in the value-added livestock export sector, the government is considering developing export meat processing zones and disease-free zones and compartments for FMD, PPR, HPAI, among others, as well as facilitating the establishment of modern slaughterhouses based on the industry's requirements. The government is also providing various schemes through the financial sector for a limited period to boost the livestock sector.

5. The focus of the current government is on breed improvement for enhanced productivity, establishing a nucleus herd, identifying breeds well adapted to various agro-ecological zones of Pakistan, and importing high-yielding exotic dairy, beef, mutton breeds, and genetic materials (semen, ova, embryos). By implementing these measures, the government aims to stimulate growth in the livestock sector, generate employment opportunities, and contribute to the overall economic growth and food security of the country.

6. The estimated livestock population and production for the last three years is given at Table –I, Table-II and Table-III respectively.

Table-I: Estimated Livestock Population (Million No)

Species	2021-22[1]	2022-23[1]	2023-24[1]	GR %
Cattle	53.4	55.5	57.5	3.77
Buffalo	43.7	45.0	46.3	2.97
Sheep	31.9	32.3	32.7	1.18
Goat	82.5	84.7	87.0	2.71
Camels	1.1	1.1	1.2	1.30
Horses	0.4	0.4	0.4	0.58
Asses	5.7	5.8	5.9	1.85
Mules	0.2	0.2	0.2	1.76

Notes:
1. Estimated Figure based on inter census growth rate of Livestock Census 1996 & 2006.

Table-II: Estimated Milk and Meat Production

Species	Units	2021-22[1]	2022-23[1]	2023-24[1]
Milk (Gross Production)	000 Tons	**65,745**	**67,873**	**70,071**
Cow	"	24,238	25,151	26,099
Buffalo	"	39,503	40,678	41,887
Sheep[2]	"	42	42	42
Goat	"	1,018	1,046	1,074
Camel[2]	"	944	956	968
Milk (Human Consumption)[3]	000 Tons	**52,996**	**54,707**	**56,474**
Cow	"	19,390	20,121	20,880
Buffalo	"	31,603	32,542	33,509
Sheep	"	42	42	42
Goat	"	1,018	1,046	1,074
Camel	"	944	956	968
Meat[4]	000 Tons	**5,219**	**5,504**	**5,809**
Beef	"	2,461	2,544	2,630
Mutton	"	782	799	817
Poultry meat	"	1,977	2,160	2,362

Notes

- *The figures for milk and meat production for the indicated years are calculated by applying milk production parameters to the projected population of respective years based on the inter census growth rate of livestock census 1996-2006*
- *The figures for the Milk production for the indicated years are calculated after adding the production of milk from camel and sheep to the figures reported in the livestock census 2006.*
- *Milk for human consumption is derived by subtracting 20% wastage (15% during faulty transportation and lack of chilling facilities and 5% in suckling calf nourishment) of the gross milk production of cows and Buffalo.*
- *The figures for meat production are of red meat and do not include the edible offal's.*

Table-III: Estimated Livestock Products Production

Products	Units	2021-22[1]	2022-23[1]	2023-24[1]
Eggs	Million No's	22,512	23,819	25,212
Hides	000 No's	19,384	20,039	20,717
Cattle	"	10,127	10,509	10,905
Buffalo	"	9,142	9,414	9,694
Camels	"	115	117	118
Skins	000 No's	62,250	63,697	65,181
Sheep Skin	"	12,088	12,231	12,376
Goat Skin	"	31,784	32,645	33,530
Fancy Skin	"	18,377	18,821	19,275
Lamb skin	"	3,590	3,633	3,676
Kid skin	"	14,787	15,188	15,599
Wool	000 Tons	48.4	49.0	49.6
Hair	"	31.0	31.8	32.7
Edible Offal's	"	465	478	492
Blood	"	77.0	79.0	81.0
Casings	000 No's	62,888	64,351	65,851
Guts	"	20,599	21,292	22,009
Horns & Hooves	000 Tons	68.2	70.2	72.3
Bones	"	1,020.7	1,052.0	1,084.3
Fats	"	322.9	332.5	342.5
Dung	"	1,448	1,493	1,540
Urine	"	437	450	464
Head & Trotters	"	290.4	298.7	307.2
Ducks, Drakes & Ducklings	Million No's	0.35	0.34	0.32

Notes

1. The figures for livestock product for the indicated years were calculated by applying production parameters to the projected population of respective years.

Poultry

7. The poultry sector is a vibrant component of the livestock industry, providing employment opportunities to over 1.5 million people in the country. With a substantial investment of more than Rs1,056 billion, this industry has experienced impressive growth, averaging a remarkable 7.3% annual growth rate over the past decade. This expansion has led to Pakistan becoming the eleventh largest poultry producer in the world, with vast potential for future growth and advancement. Poultry sector is contributing around 40.7% of the country's gross meat production.

8. To further strengthen and develop this industry, the poultry development strategy focuses on key areas such as disease control, utilizing cutting-edge technology for poultry production in controlled environments, processing and value addition, improving poultry husbandry practices, and expanding product diversification. In order to achieve these goals, the Government of Pakistan has implemented farmer-friendly policies and interventions to support both rural and commercial poultry production.

9. Despite its growth and potential, the poultry sector in Pakistan faces various challenges, including disease outbreaks, feed quality issues, high production costs, non-availability of locally

grown crops like soybean and market fluctuations. Addressing these challenges is essential for sustaining the sector's growth and ensuring food security in the country.

10. Table-IV displays the estimated production of commercial and rural poultry and poultry products over the last three years

Table –IV: Estimated Domestic/ Rural & Commercial Poultry

Type	Units	2021-22[1]	2022-23[1]	2023-24[1]
Domestic Poultry	**Million No's**	92.62	94.04	95.50
Cocks	"	13.20	13.55	13.92
Hens	"	45.52	46.34	47.17
Chicken	"	33.90	34.15	34.41
Eggs[2]	"	4552	4634	4717
Meat	000 Tons	129.76	132.36	135.01
Duck, Drake & Duckling	**Million No's**	0.35	0.34	0.32
Eggs[2]	"	15.78	15.12	14.49
Meat	000 Tons	0.48	0.46	0.44
Commercial Poultry	**Million No's**	1632.06	1792.46	1968.71
Layers	"	68.49	73.28	78.41
Broilers	"	1,548.51	1,703.36	1,873.69
Breeding Stock	"	15.06	15.81	16.61
Day Old Chicks	"	1,617.41	1,779.16	1,957.07
Eggs[2]	"	17,944	19,170	20,480
Meat	000 Tons	1846.48	2027.57	2226.54
Total Poultry				
Day Old Chicks	Million No's	1,651	1,813	1,991
Poultry Birds	"	1,725	1,887	2,065
Eggs	"	22,512	23,819	25,212
Poultry Meat	000 Tons	1,977	2,160	2,362

Notes

1. The figures for the indicated years are statistically calculated using the figures of 2005-06.
2. The figures for Eggs (Farming) and Eggs (Desi) are calculated using the poultry parameters for egg production.

Projects in Livestock Sector

11. The following are the projects being executed or proposed in the livestock sector at National level:

12. **Antimicrobial Resistance (AMR).** DAI Pakistan, in collaboration with the Ministry of National Food Security and Research, executed the Fleming Fund Country Grant Pakistan Phase I (2019-June 2023), aimed at combating antimicrobial resistance (AMR). Phase I focused on enhancing policy environments, improving surveillance, strengthening laboratories, and promoting a One Health approach. Government of UK has provided 2.8 million pounds sterling both for human and animal sectors. Key achievements included developing surveillance strategies, refurbishing laboratories, conducting surveys, and initiating advocacy efforts.

13. Following the successful implementation of Phase-I, the UK government has allocated an additional grant of 6 million pounds sterling for Phase II of the Fleming Fund Country Grant (FFCG), which began in January 2024 and is scheduled to conclude in December 2025. This phase emphasizes producing high-quality data, conducting thorough analysis, fostering data sharing, and ensuring sustainable investments. The MoNFSR AMR Coordination Unit (AMR-CU), established in Phase I, will oversee initiatives in the animal health sector, including passive and active surveillance, data collection on antibiotic importation, advocacy for

rational drug use, and facilitating the National Action Plan for AMR control. This strategic framework aims to address the challenges posed by AMR comprehensively and sustainably.

14. **National Program for Animal Disease Surveillance, FMD Control and Animal Track and Traceability – in Compliance with National and International Standards (Cost Rs. 8,150 million):**

The Livestock Wing of Ministry of National Food Security and Research has formulated a PC-I The National Program for Animal Disease Surveillance, FMD Control, and Animal Track and Traceability-in Compliance with National and International Standards which is a comprehensive initiative designed to enhance the management and control of animal diseases in alignment with national and international standards.

15. With an investment of Rs. 8,150 million, the program is comprised of three distinct components of Disease Surveillance, Animal Identification and traceability and Official Contyrol Programme for Foot and Mouth Disease (FMD). The proposed Pakistan Animal Health Information and Track and Traceability System utilizes the latest technological advancements, enables real-time reporting of animal diseases. This facilitates appropriate and timely actions for disease control, prioritizing resource allocation for prevention efforts. The system provides critical information to farmers, veterinarians, and other stakeholders, enabling them to respond to outbreaks promptly and efficiently. By minimizing the impact of animal diseases on the economy and public health and safeguarding the food supply chain, the will contribute significantly to national welfare.

16. National Animal Identification and Traceability programme is built on the previous activities of the technical copperationprogrammeTCP/PAK/3804 - FAO-Pakistan "Support Development and Piloting Pakistan Animal Identification and Traceability System (PAITS)" The successful pilot phase has demonstrated the feasibility and effectiveness of the software system, paving the way for its nationwide implementation. This project will extend the scope of this pilot activity and extend it to the whole country. Animals and their premises will be registered along with other useful data. The whole system of identification will be digital and based on dashboard for effective monitoring, ease of usage interoperability and applicability.

17. The third component of the project is Official Foot-and-Mouth Disease (FMD) control programme which is essential to act as an overarching programme to cater the needs of the provinces in order to control FMD in the country. Official Control Programme is designed to address the specific needs and activities to strengthen the initiatives to control FMD . By integrating these components, the project will improve disease monitoring, support rapid response to outbreaks, and ensure the traceability of livestock products, thereby safeguarding public health, boosting animal welfare, enhance access to high end markets and strengthening the overall resilience of the Livestock sector.

18. **National Peste des Petits Ruminants (PPR) Eradication Programme; Phase-I, Risk Based PPR Control in Sheep and Goats of Pakistan:** This project was initiated in 2020-21 with an allocated budget of Rupees 1787.71 million by the National Veterinary Laboratory. It is in line with international commitments to eradicate the PPR disease by 2030. PPR, a highly contagious viral illness affecting sheep and goats, poses significant threats to animal health, livestock trade, and farmer livelihoods due to its high morbidity and mortality rates. The successful completion of this initiative is set to make Pakistan PPR disease-free and eligible for World Organization for Animal Health (OIE) Certification.

19. Key activities within the project encompass the procurement and distribution of PPR vaccines, training of veterinary personnel in sample collection, storage, and diagnosis, and provision of necessary laboratory equipment. A total of 19.85 million doses of PPR vaccine have been procured and distributed, with preventive vaccination campaigns commencing from May 2022. Provinces maintain emergency reserves, and awareness materials are circulated among farmers to facilitate disease control efforts.

20. **Pakistan's Collaboration with World Organization for Animal Health (WOAH) for Animal Health and Trade:** Compliance with WOAH standards are essential for maintaining sanitary trade between countries, as mandated under WTO agreements. Member countries, including Pakistan, must regularly report animal disease data to WOAH to inform trading partners and facilitate trade. To streamline this process, WOAH manages the online World Animal Health Information System (WAHIS), where the office of Animal Husbandry Commissioner submits data biannually and immediately for Transboundary Animal Diseases (TADs), zoonotic diseases and emerging/re-emerging animal diseases, crucial for trading partners of regional and international markets.

21. Similarly, WOAH is maintaining an online system ANIMUSE for surveillance of Antimicrobial Use (AMU) data in the animal health sector around the globe. Livestock Wing successfully submitted the 9th round of data collection on AMU. The data submission helps to quantify the burden of antimicrobials being used in the animal health sector and can help to formulate evidence-based policy decisions to contain the threat of antimicrobial resistance.

22. WOAH plays an important role in improving veterinary infrastructure and capacity-building in Pakistan and has allocated 30,000 USD for Provincial Antimicrobial Use (AMU) workshops and Veterinary Education Establishments seminars. 15,000 USD has been released in the 1st phase, which is currently being utilized. Furthermore, WOAH-sponsored technical experts actively contribute to legislative efforts, exemplified by their involvement in drafting "The Pakistan Animal Health, Welfare and Veterinary Public Health Act." This legislation aims to observe international standards in disease surveillance, animal welfare, and veterinary public health. Additionally, WOAH's engagement in programs like the WOAH Laboratory Training Program, Performance of Veterinary Services (PVS) evaluations and veterinary service gap analysis highlight its commitment to improve in Pakistan's veterinary services, thus enhancing the sector's overall performance.

23. Market Access of New Export Avenues:

Livestock Wing is actively pursuing new markets for the export of meat, dairy and other animal origin products. In the last FY 2023-24, Pakistan gained market access for export of heated beef, dairy products and donkey hides to China. Three protocols pertaining to the export of above-mentioned products were signed between General Administration of Customs of China (GACC) and Ministry of national Food Security and Research. Two companies i.e The Organic Meat Company and Tata Best Foods were successfully registered with GACC for export of heat-treated beef and one company i.e Gourmet Foods was registered with GACC for export of dairy products. Several companies are in the process of registration with GACC through Livestock Wing to enhance exports. Beside this many new exporters are registered with competent authorities in kingdom of Saudi Arabia, UAE, Iran, Uzbekistan, and other countries.

24. National Animal Health, Welfare and Veterinary Public Health Bill:

Livestock Wing has prepared a National Animal Health, Welfare and Veterinary Public Health Bill with due consultation of international and national veterinary and law experts keeping in view the international practices and context, obligation and requirements surrounding animal health, animal welfare for sustained international trade, local animal production, disease surveillance, regulation of veterinary diagnostic/ research laboratories and regulation of veterinary drugs and vaccines etc. The Bill was presented before the Cabinet for approval in Principle and the cabinet was pleased to approve the bill to start the legislation process. This legislation holds a paramount importance and will act as an overarching legislation to cover national and international requirements.

25. Export of Animal Casings to the EU:

Livestock Wing in collaboration with Animal Quarantine Department and NIAB laboratories Faisalabad successfully submitted annual residue monitoring plan for export of animal casings to the EU countries. Implementations of this residue plan ensure sustained exports of animal casings to the EU. Furthermore, four new companies i.e M/s IHK Foods, M/s Zulfiqar Sheep Casings, M/s Universal casings and M/s Five Stars casing have been enlisted with EU on the online TRACES NT system for export of animal casings to the European union

26. Donkey Meat and products Export to China:

The export potential of donkey meat and products is increasingly recognized as a niche market with significant opportunities for growth. Donkey meat, valued for its lean, high-protein content and distinct flavor, is gaining traction in international markets, particularly in regions with established culinary traditions or a growing demand for diverse protein sources. Countries like China, have long appreciated donkey meat and its products like Eijiao for its benefits. Additionally, donkey-derived products such as hides, used for leather and traditional crafts are attracting attention in non-food sectors. Based on demand from China, there is a promising market opportunity for exporters to tap into. Federal Cabinet has approved a protocol entailing sanitary requirements for export of donkey meat and donkey hides to china in order to attract foreign direct investments and strengthen the bilateral relations with China. A number of Chinese companies are interested to invest in Pakistan and export donkey hides and meat with other products.

27. **M/s Han Geng (SMC) Pvt** Ltd is establishing a slaughterhouse in Gwadar Free Zone exclusively for the purpose of exports. The company is also establishing donkey breeding farms in the country for seamless supply of the donkeys. This provides a unique opportunity for investment and to explore the potential of donkeys apart from their usage as draught purpose. This can lead to the development of donkey farming and allied businesses in the country and provide livelihoods to the farmers and especially the most impoverished communities rearing donkeys. M/o NFS&R is committed to regulate the export of donkey meat, hides and products with explicit permissions to establish processing units only in Gwadar Free Zone to prevent adulteration of local food chain and establishment of donkey breeding farms to prevent slaughtering of local population and its depletion. Moreover, investors are encouraged to establish donkey breeding farms to uplift this sector in the country.

28. Protocols Signed with China for Export:

The Chinese market presents a lucrative opportunity for exporting animal products due to its large and rapidly growing consumer base with increasing demand for high-quality, diverse food options. China's expanding middle class and evolving dietary preferences are driving a surge in the consumption of meat and dairy products, creating significant export potential. Additionally, the country's efforts to modernize its food supply chain and improve food safety standards further enhance the prospects for international suppliers. Based on this demand and to increase the much needed exports, MoNFS&R signed a number of protocols with General Administartion of Customs China for export of different animal products from Pakistan to China as listed below:

- Protocol between General Administration of Customs of China and the Ministry of National Food Security &Research of Islamic Republic of Pakistan on inspection and quarantine and Veterinary Sanitary requirements for heated beef to be exported from Islamic Republic of Pakistan to Peoples Republic of China.

- Protocol between General Administration of Customs of China and the Ministry of National Food Security &Research of Islamic Republic of Pakistan on quarantine and sanitary requirements of Donkey hides for processing purpose to be exported to China.

- Protocol between General Administration of Customs of China and the Ministry of National Food Security &Research of Islamic Republic of Pakistan on inspection and quarantine of dairy products exported from Islamic Republic of Pakistan to Peoples Republic of China.

- Protocol between the General Administration of Customs of the People's Republic of China and the Ministry of National Food Security and Research Government of Islamic Republic of Pakistan on Inspection, Quarantine and Sanitary Requirements for Donkey Meat to be exported from Pakistan to China.

Other Policy Measure

29. The Livestock Wing, with its redefined role under the 18th Constitutional Amendment, facilitated the import of the following during the financial year Jul, 2023- March 2024:

a) 244.2 tons of calf milk replacer valued at 453.5 thousand USD by the corporate dairy subsectors
b) 487 tons of cattle feed premix valued at 728.1 thousand USD by the corporate meat subsectors
c) 2.65 million doses of high yielding dairy cattle breeds of Holstein Friesian and Jersey for enhanced milk production and Brahman for enhanced meat production.
d) In order to facilitate the private sector, the Animal Quarantine Department has been entrusted for integrating the necessary certifications with Pakistan Single Window for harmonizing the trade of animals and animal origin products.

FUTURE PLANS

30. The Future Plans will continue to focus on

a. Inter – Provincial Coordination for development of livestock sector,
b. Coordination with private sector to promote value addition in livestock industry and diversification of livestock products,
c. Control of Trans-boundary Animal Diseases (FMD, PPR, LSD, Bird Flu etc.) of trade and economic importance through provincial participation,
d. Implementation of National Foot and Mouth Disease (FMD) Official Control Program in the country that will facilitate entry into international markets such as Indonesia, Malasia, China etc.
e. Exploring new markets for export of halal meat and dairy products with focus on Global Halal Food Trade Market
f. Development of National Livestock Breeding Policy, 2022
g. Development of National Poultry Policy
h. Development of Export Policy for livestock Products
i. Breed improvement under Agriculture Transformation Plan; that has the objective to enhance national agricultural output and livelihood of farmers.
j. Task Force on Livestock for sectoral development.

PART –II

ATTACHED /AUTONOMOUS DEPARTMENT OF M/O NFS&R

6. NATIONAL FERTILIZER DEVELOPMENT CENTRE (NFDC)

National Fertilizer Development Centre (NFDC), a multi-disciplinary technical section was established in 1984 under the umbrella of Planning and Development Division. In 2018, the centre was transferred from M/o Planning, Development and Special Initiatives to M/o National Food Security and Research (NFS&R). The key function of NFDC is to give unbiased policy recommendations on various fertilizer related issues from factory gate or port of entry to farmer field. The Centre, in addition to providing technical support to M/o NFS&R on fertilizer related issues, gives advice to different federal Ministries, provincial Agriculture Departments and other public sector entities on various technical matters.
It also provides information / data to international organizations like International Fertilizer Association (IFA) and FAO of United Nations, etc.

i. Organized a series of meetings of high-level committee of Parliamentarians constituted by Prime Minister's Office to resolve fertilizer supply chain and price issues and submitted recommendations to PM Office, accordingly.
ii. On the basis of NFDC forecast, full quantity of allocated gas is being provided to FFBL plant resulting in smooth availability of urea and reduced reliance on import. This initiative has resulted in additional urea production of 30 thousand tonnes per month.

- **Monthly Fertilizer Review Reports**
  NFDC published twelve (12) monthly fertilizer review during 2023-24, which provided updates on supply / demand situation of different fertilizer in general and that of urea and DAP in particular. Further, international and domestic prices of fertilizer products are also reported for the readers.

- **Annual Fertilizer Review**
  Publication of Annual Fertilizer Review (AFR) is one of the regular activities of NFDC. The AFR 2022-23 has been published. It contains season wise (Kharif2022&Rabi 2022-23) and financial year wise (2022-23), extensive details of supply/demand situation, domestic production, import and offtake at national, provincial and district level along with domestic and international price trend etc. Collection and compilation of the date for AFR 2023-24is in process.

- **Fertilizer Demand Forecasting**
  Fertilizer demand forecastingwas done on short, as well as long-term basis. Under short term approach, the monthly fertilizerdemands up to Kharif (September) 2024 was estimated, while on long term basis, annual estimates up to 2029 were calculated.

- **Pakistan Fertilizer Statistics**
  Compilation of Pakistan Fertilizer Statistics is under process. This voluminous publication covers data regarding fertilizer production, imports, exports, offtake, prices etc. (on time series basis) both at national and international level of the last 15 years.

- **Input for setting Pakistan Standards of Fertilizers by PSQCA.**

Draft Pakistan Standards of following fertilizers and allied products were examined and comments were offered.

i. "Optional parameters in PS-5336".
ii. "Standard Urea (46%N) VS value added products of Urea (Zabardast & Neem Coated Urea).
iii. Adoption of ISO analytical methods.
iv. Magnesium Sulphate.

Other Important Activities

iii. Website of NFDC (www.nfdc.gov.pk) was updated. It contains time series data regarding fertilizer production, import, offtake and domestic and international price trend since 1989-90. Data pertaining to area, production and yield of major crops is also updated for facilitation in analysis.
iv. Regularly updated and maintained national data on fertilizer production, imports, sales, domestic and international prices. NFDC also maintained the relevant record of data up to district level.
v. NFDC participated and contributed in the meetings convened by Federal Committee on Agriculture (FCA), Fertilizer Review Committee (FRC), Pakistan Standard and Quality Control Authority (PSQCA) and Agriculture Policy Institute (API).
vi. NFDC has provided information and technical support to Ministry of National Food Security & Research to ensure timely availability of fertilizer at affordable prices.
vii. Regularly updated Ministry dashboard pertaining to Urea and DAP supply/ demand (production, import, offtake) and price situation on weekly basis.
viii. Reply to National Assembly / Senate questions relating to fertilizer availability and prices were prepared for M/o NFS&R.
ix. Fertilizer related statistics including prices and offtake along with analysis was provided to Ministry of Finance for Economic Survey 2023-24.
x. Centre provided information/data in the form of questionnaire and position papers to international organization like International Fertilizer Association (IFA), Paris, France and Food and Agriculture Organization (FAO) of United Nations.
xi. Data was provided to Economic Wing M/o, NFS&R for Agriculture Statistics of Pakistan 2022-23.
xii. The complaints/suggestions received on NFDC dashboard; Prime Minister Delivery Unit (PMDU) portal were responded timely.
xiii. Contributed and provided information/data in the form of briefs and position papers to national organization like Pakistan Bureau of Statistics (PBS), Federal Board of Revenue (FBR), Ministry of Industries and Production, Ministry of National Food Security and Research (NFS&R), provincial agriculture departments and Fertilizer Industry like Fauji Fertilizer Company (FFC), Engro Fertilizer Limited (EFL) etc.
xiv. NFDC provided technical assistance/comments on "Draft South Asia Road Map for Sustainable Nitrogen Management 2024-2030" and participated in consultative workshop on the Draft Resolution which was going to be adopted at the 16th meeting of Governing Council of South Asia Co-operative Environment Programme (SACEP).
xv. Assisted Ministries of Petroleum, Industries & Production, Commerce and Finance through technical expertise and data input keeping ever changing scenario of the fertilizer sector in an oligopolistic market.
xvi. Provided comments supported by technical analysis on policy issues like export of micronutrient fertilizers, establishment of green hydrogen plant, use of CAN fertilizer in terrorist activities and PEC's "Make in Pakistan Policy''.
xvii. NFDC provided technical assistance and actively participated in consultative meetings with USDA Scientists arranged by ICARDA on implementing a USDA-sponsored project on "Fertilize Right Pakistan with the objectives to determine Fertilizer Use Efficiency, Effectiveness, and Alternate Bio/organic Sources".

xviii. NFDC Participated and defended M/o NFS&R to resolve fertilizer issues filed in different courts of Pakistan.

xix. The E-office initiative launched by NITB of M/o Information Technology & Telecom under the directive of PM office has been adopted successfully.

xx. NFDC comments on "Declaration of Pine Nut Processing Plant Agric Park Waria as Trade Transit Point for value Addition processing of Pine nut for Export by Exempting Import/Export Duties" were forwarded to M/o Planning Development & Special initiatives.

xxi. Comments of NFDC about "Development of Coal Gasification Policy" were provided to Director Mining, M/o Energy (Petroleum Division), Islamabad.

xxii. Comprehensive Data on various aspects of Fertilizer Sector for Informed Decision-Making, were provided to Energy Consultant, Strategic Delivery Unit, M/o Energy (Petroleum Division) Islamabad.

xxiii. NFDC convened a meeting of stakeholders on Fertilizer Supply Chain and Prices issues on 31st May, 2024 and committee gave recommendations to resolve issues.

7. National Veterinary Laboratories (NVL)

The National Veterinary Laboratory (NVL) is a subordinate office of the Ministry of National Food Security and Research and is a designated National Reference Laboratory for livestock diseases in the country. It provides essential veterinary laboratory services to support the national livestock sector, with the ultimate goal of enhancing profitability in livestock farming through effective disease control measures. It is maintaining ISO 9001:2015 certification by implemented Quality Management System (QMS). It is also have testing accreditation (ISO/ IEC 17025: 2005) for FMDV diagnosis and serotyping as well as Extended Spectrum Beta-Lactamase (ESBL) Escherichia coli (E. coli) detection.

Following are the core functions of the NVL:

- Serving as the National Reference Laboratory for Transboundary Animal Diseases (TADs) as well as diseases of zoonotic, trade, and economic significance.
- Performing residue analyses in livestock and poultry products, as well as by-products, to ensure compliance with the sanitary and phytosanitary (SPS) requirements of the European Union (EU) and the World Trade Organization (WTO).
- Conducting quality testing of veterinary medicines and vaccines to ensure their safe and effective use in animals.
- Offering technical assistance to provincial and regional livestock departments in managing highly pathogenic emerging animal diseases as they arise.
- Providing training programs and refresher courses on advanced diagnostic technologies in the field.
- Collaborating with provincial and regional livestock departments and international organizations, including the World Organization for Animal Health (WOAH), Food and Agriculture Organization (FAO), World Health Organization (WHO), and The Flaming Fund UK to enhance animal health and public health standards.
- Additionally, NVL initiated Diagnostic Services for the detection of antimicrobial-resistant pathogens, and the institution is currently serving as the focal point for AMR in the country.

Technically, NVL is divided into four main labs: Disease Diagnosis & Surveillance (D&S), Vaccine Quality Control (VQC), Residue & Drug Testing (RDT) and Emerging Diseases (ED). During the year 2023-24, the D&S section of NVL played a pivotal role in controlling highly contagious TADs such as FMD, PPR and Lumpy Skin Disease (LSD) in the country. It served as a significant and strategic platform for controlling these diseases, which pose significant threats to economy, food security, and the health of both animals and humans. D&S section collaborated closely with provincial/regional livestock departments alongside international partners such as the WOAH, FAO and WHO of the United Nations. This collaboration aimed to effectively control livestock diseases, one health concerns and preventing their cross-border spread. A significant accomplishment was the collaborative effort with FAO and World Reference Laboratory (WRL) UK to conduct molecular characterization of the FMD virus. This joint activity provided valuable insights into various FMD virus subtypes and facilitated the matching of strains for vaccine development. Consequently, Pakistan was able to formulate country-specific and effective FMD vaccines tailored to its requirements.

Fig.1. Training of Gilgit-Baltistan and Azad Kashmir Diagnostic Laboratories technical staff for their capacity building related to Antimicrobial Resistance (AMR) at National Veterinary Laboratory Islamabad.

Furthermore, the section actively **collaborates with the WHO and the Fleming Fund UK** to implement animal health initiatives under the National Action Plan on Antimicrobial Resistance (NAP-AMR). A series of coordinated activities, supported by the Fleming Fund Country Grant and WHO Pakistan, underscores their commitment to safeguarding animal and human health within the country.

During 2023-24, successful visits occurred between Chinese and Pakistani delegations. In September 2023, a Chinese delegation visited Pakistan, followed by a Pakistani delegation visiting China in February 2024, under the twinning project on Brucellosis between the China Institute of Veterinary Drug Control (IVDC) Beijing and NVL Islamabad. These visits supported and funded by WOAH, included two-week hands-on training program where Chinese experts trained professionals of NVL.

Fig.2. Visit of Chinese delegation from China Institute of Veterinary Drug Control (IVDC) Beijing to National Veterinary Laboratory Islamabad for training and enhancing the Brucellosis diagnostic capacity under the WOAH Laboratory Twining Project.

Fig.3. Visit of Chinese delegation from China Institute of Veterinary Drug Control (IVDC) Beijing to National Veterinary Laboratory Islamabad for training and enhancing the Brucellosis diagnostic capacity under the WOAH Laboratory Twining Project.

Fig.4 Training program for the technical staff of Disease Diagnosis and Surveillance section of NVL on Bacterial confirmation and its AST (MIC) on BD Phoenix & MALDI-TOF arranged by the Fleming Fund UK.

The Vaccine Quality Control (VQC) Section is a distinguished facility offering testing services for high-quality veterinary vaccines to provincial and regional livestock departments upon request. It serves a vital role in monitoring key and strategic vaccines such as Avian Influenza (AI), FMD, PPR, Newcastle Disease (ND), Hemorrhagic Septicemia (HS), Black Quarter (BQ) and Enterotoxaemia (ET), contributing significantly to diseases control efforts nationwide. VQC serves as a third-party quality evaluator for veterinary vaccines and focuses on finished (end) product quality testing, including essential assessments such as sterility, safety, efficacy/potency, and physiochemical analysis. During the 2023-24 period, this section received 42 veterinary vaccines for diseases such as FMD, PPR, ND, HS, ET, BQ, Mastitis, and Contagious Pleuropneumonia (CPP).

One of the mandates of the National Veterinary Laboratory (NVL) is the analysis of veterinary pharmaceutical residue in animal-originated products such as meat (beef, mutton, chicken), milk, egg, honey, and others to comply the food safety measures. In this regard, the National Residue Monitoring Plan is prepared to conduct the surveillance of targeted veterinary pharmaceuticals especially antimicrobial drug residue maker(s) in these livestock products to improve the food safety standards for the consumer in Pakistan and trade. NVL is collaborating with provincial food safety authorities on this food safety problem.

Emerging Disease Section (ED) aims to safeguard animals and humans from domestic and global health threats by promptly identifying, diagnosing, and controlling new disease outbreaks throughout Pakistan. During the period of 2023-24, NVL provided advanced diagnostic technology, training sessions, and refresher courses. The institution also supported internship programs for Doctor of Veterinary Medicine (DVM) and other allied fields and facilitated M.Sc., M.Phil., and Ph.D. studies, aligning with its objectives.

NVL continued the execution of the PSDP project titled "National Peste des Petits Ruminants (PPR) Eradication Program: Phase 1 - Risk-Based PPR Control in Sheep and Goats in Pakistan." The total allocation of the project is Rs. 1787.71 million for a duration of five years (2020-25). Its main goal is to eradicate PPR in sheep and goats across Pakistan. The incidence of the disease is significantly reducing yearly and contributing in socioeconomic uplift of small ruminant farmers.

OTHER ACHIEVEMENTS:

- Key partner of FMD, PPR and all other animal diseases control programs currently executed in the country and Pakistan is at stage 2 of Progressive Control Pathway (PCP) for FMD and PPR at international level.
- Strengthen eight ELISA labs in collaboration with FAO, at strategic locations for diagnosis of TADs (FMD & PPR) in all the provinces/regions of the country.
- Technical backstopping and support to international labs in Afghanistan, Tajikistan, Uzbekistan and Turkmenistan.
- Annual national refresher training courses for laboratory workers on AMR, FMD & PPR diagnosis from all relevant provisional / regional labs.
- Prepared a National Residue Monitoring Plan for surveillance of targeted residue markers in veterinary pharmaceuticals in edible livestock products to enhance food safety measures.
- A pilot study for the Islamabad Capital Territory (ICT) is completed for surveillance of three targeted residue markers of veterinary pharmaceuticals in edible livestock products.
- NVL has participated in proficiency testing for different pathogens (FMD, E. coli and Enterococcus) and also participated in proficiency testing for different bacterial sample (NEQAS program NIH and by Chulalongkorn University).
- Established FMD virus repository (100 fully characterized FMD virus isolated from Pakistan).
- Provided internships to more than 50 Internees (DVM and other allied fields), and research facilitation to B. Sc, M.Sc., M. Phil and Ph. D students from different universities.
- Collaboration with FAO, WHO, WOAH regarding implementation of International Health Regulation (IHR) -2005 activities in veterinary sector of Pakistan.
- Established National Veterinary Laboratory Working Group.
- More than 150 veterinary officers / para veterinary staff trained in various training programs.

SECTION-WISE PROGRESS REPORT JULY 2023 To JUNE 2024

Section: Disease Diagnosis &Surveillance: VIROLOGY & MOLECULAR LAB		
Activities	**Area**	**Samples Analyzed**
Indirect ELISA for antibody detection for Brucellosis	Peshawar, Sargodha, Kasur, Fateh Jhang, ICT	253
FMD sero-surveillance Trapping indirect ELISA for FMD-NSP antibodies detection	ICT, Rawalpindi, Talagang, Sheikhupura	1352
Capri pox double antigen ELISA for Lumpy Skin Disease	Faisalabad	25
Indirect sandwich ELISA for FMD serotyping	ICT, Rawalpindi	66
FMD antigen detection ELISA	ICT	05
Solid phase ELISA for FMDV serotypes	Lahore, Talagang, Haripur	879
PPR antigen captured ELISA	AJK, Rahim Yar Khan, Rawalpindi	692
Hematological analysis of blood samples (CBC)	ICT, Rawalpindi	224
Sero-prevalence of PPR antibodies using cELISA	Khyber, Rahim Yar Khan, Jaba, ICT, Quetta, Peshawar, Nowshera, AJK	2224
PCR PPR	ICT	27
Mycoplasma detection in vaccine samples		05
Total		**5752**

Section: Disease Diagnosis &Surveillance: BACTERIOLOGY LAB		
Microbiological examination of milk samples	LRS NARC, ICT, Rawalpindi	285
Microbiological examination of water samples	ICT, Rawalpindi	98
Microbiological examination of tissues, pus & others culture samples	ICT, Rawalpindi	24
Microbiological examination of fecal samples	ICT, Rawalpindi	49
Biochemical examination of milk using commercial strips	LRS NARC, ICT, Rawalpindi	285
Mastitis test	LRS NARC, ICT, Rawalpindi	285
Antibiotic culture sensitivity	NEQAS, EQAsia, LRS NARC, ICT, Rawalpindi	2295
Microbiological examination for ESBL E. coli, Klebsiella pneumoniae (KP), Salmonella species from chicken samples	ICT, Rawalpindi	253
Microbiological examination for carbapenemases E. coli and KP from chicken samples	ICT, Rawalpindi	253
Microbiological examination for Campylobacter species from chicken samples	ICT, Rawalpindi	253
National External Quality Assessment Services (NEQAS) for provincial veterinary	National Veterinary Lab, NEQAS, EQAsia	880

labs supported by Fleming Fund organized by External Quality Assessment Services		
Hands on Training on Isolation and Identification of carbapenemases and ESBL E. coli and KP to provincial labs	AJK & Gilgit-Baltistan	08 Participants
Participated in proficiency testing Chulalongkorn University	NVL	50 samples processed
Isolation and identification of ESBL E. coli in water & chicken ceca from North Waziristan	NVL	400
Bacterial confirmation and its AST (MIC) on BD Phoenix & MALDI-TOF	NVL	242
Total		**5652**
Section: Disease Diagnosis &Surveillance: PARAHISTO LAB		
Faecal examination techniques for endoparasites	ICT, Rawalpindi, Remount Vet Depot, NIH	323
Blood smear examination techniques for Haemoparasites diagnosis and confirmation	ICT, Rawalpindi, Remount Vet Depot, NIH	359
Total:		**682**
Section: Vaccine quality Control Section: Vaccine Quality Control Lab:		
Test performed at VQC Lab (sterility bacterial, sterility fungal, safety test, protein estimation, moisture analysis, vacuum testing, viscosity, antigen identification, mycoplasma detection, pH testing & residual Formalin estimation)	Sindh, Punjab, Islamabad	1864
Maintenance of animal house (mice, rabbits & poultry)	NVL	2330
Total:		**4194**
Section: Drug Residue Section: Residue & Drug Testing Lab		
National Residue Monitoring Plan: Residue analysis for Ciprofloxacin and Chloramphenicol residue markers in livestock products collected from Islamabad.	ICT (85 samples × 3 residues marker)	255
Research samples analysis for three metals (lead, zinc, cadmium) from COMSATS University Islamabad	COMSATS University	170
Residue detection in honey by HPLC & internship students' samples	NVL	20
Standardization of new protocol for residue detection in honey samples by HPLC under validation	NVL	54
Total		**499**
Grand Total		**16744**
Other Activity:		
ISO-9001:2015 certification		Completed
ISO-17025-2017 certification (selected tests)		Completed
Internees (Bahauddin Zakariya University Multan, University of Bahawalpur, University of Veterinary & Animal Sciences Lahore &Jhang campuses, Islamic		124

International University Islamabad, Abasyn University Islamabad, Agriculture University Peshawar, Abdul Wali Khan University Mardan)	
Postgraduate students (University of Science and Technology Abbottabad, COMSATS Islamabad, Islamic International University Islamabad)	16
WOAH-Lab twinning project training on Brucellosis.	
Training on the capacity building of sentential/provincial laboratory for participation in NEQAS activity.	
Arranged world antimicrobial awareness week in National Veterinary Laboratory Islamabad.	
Participated in world antimicrobial awareness week arranged by National Institute of Health Islamabad.	
Participated in world antimicrobial awareness week arranged by National Agriculture Research Center Islamabad.	
Training received on the most advanced technique for identification of bacteria and their antibiotic sensitivity test by using BD Phoenix & MALDI-TOF.	
Facilitated 10 different universities students tour at NVL.	
Three days hands on training to 48 skill university students on basic tissue processing techniques.	

Samira Ameen
RO (EC-II)
Tuesday, 04 February, 2025, 4:33:58 PM

8. DEPARTMENT OF PLANT PROTECTION (DPP)

DETAILS ACTIVITIES, ACHIEVEMENTS & PROGRESS DURING PROCEEDING FINANCIAL YEAR 2023-24.

1 PLANT QUARANTINE:

The Department of Plant Protection (DPP), the NPPO of Pakistan play its regulatory, advisory and R&D roles as per its mandate in exportation of plant and plants material under the provision of Pakistan Plant Quarantine Act, 1976 and Rule 1967 and the International Standard for Phytosanitary Measures (ISPMs) developed under the WTO-SPS negotiated International Plant Protection Convention (IPPC) of 1997.

To further boost the export of plant and plant materials steps have been taken by the Department of Plant Protection with trading partners in the light of MOUs signed with different countries.

Market Accesses

France

- A committee comprising of Mr. Waqas Ali Mehmood (Additional Secretary, MNFSR), Mr. Shahid Abdullah (Director Technical, DPP, Islamabad) and Dr. Muhammad Ishfaque (Dy. Director, DPP, Lahore) on the subject cited above and to state that finalization of pest risk analysis implies consideration of various factors which were witnessed all steps of pest surveillance, pest mitigation measures, supply chain including production system, area harvest, post-harvest handling, storage, processing, seed treatment system, washing, grading, packaging, labelling, transportation, quarantine inspection and Phytosanitary certification system, reliable system of traceability, documentation and safe pathway and minimal bio-security risks, physically and found in accordance with ISPMs, FAO guidelines and DPP regulations.
- Pakistani delegates/audit team recommended to grant a market access to import of seed potato for sowing purpose into Pakistan from France. However, Ministry of National Food Security and Research is requested to sign a work plan for import of potato seeds from France to Pakistan for sowing purpose.

Iran

- Pakistan has been exporting a number of agro-commodities to Iran, after conducting pest risk analysis particularly rice and mango etc.
- Due to continuous efforts and successful negations of DPP with NPPO Iran, Quarantine Experts from Plant Protection Organization, PPO Iran visited Pakistan in June 2024 and granted approval to the following Hot Water Treatment Plants to disinfest mangoes destined to Iran from Pakistan.

Name of HWT Facility	Location of Facility
RMC HWT plant	Karachi
Get Fresh HWT Plant	Karachi
Iftekhar Ahmed HWT	Karachi
Aurangzeb and brothers HWT Plant	Karachi
Saad Eco Farm HWT Plant	Karachi
Agro Green HWT Plant	Karachi
Pak Sun Green HWT Plant	Karachi
SMA Enterprises HWT Plant	Karachi
Pak Agri Sun HWT plant	Karachi
Hydershah HWT plant	Karachi
Sitara Traders HWT Plant	Lahore

Farova Exports HWT	Lahore
Mg Agri HWT	Multan
Abdullah M Owais HWT Plant	Multan
FB Exporters HWT Plant	Multan
Lutfabad HWT Plant	Multan
AZZ HWT Plant	karachi

- Total Mango Exports in the year 2024 is 138663.2867 MT with foreign exchange worth 94567108.9505 USD. This year Pakistan exported 50537.6260 MT mangoes to Iran with foreign exchange of almost 29554215.6650 USD.

Russia

- Pakistan is exporting agricultural goods from Pakistan to Russian Federation. Currently Russia has allowed only four Rice establishments to export rice from Pakistan to Russia. To further enhance the export of rice from Pakistan to Russian Federation, the department with the collaboration of Rice Exporters Association of Pakistan (REAP) has commenced technical audit of rice establishments/ facilities of the potential rice exporters. As soon as the audit process is finalized the department will share name of the successful/ recommended rice facilities with the NPPO – Russia for virtual/ video inspection an approval.

China

- Pakistan is exporting a number of agro-commodities to China after conducting pest risk assessment, particularly rice, citrus and mango.
- So far GACC/ NPPO – China has approved 53 rice establishments for export of rice from Pakistan to Russian Federation. To further increase export of rice DPP has recommended 5 more rice facilities to GACC/ NPPO – China for approval.
- After successful negotiations with GACC/ NPPO – China, a protocol for export of Onion from Pakistan to China has been signed on 23-11-2021.
- For grant of market access for export of cherries from Pakistan to China, DPP has currently shared its views/ comments with GACC/ NPPO – China on revised draft of protocol.
- China has also agreed to grant market access to Pakistan for export of Rhodes grass to China and conveyed a protocol on sanitary and phytosanitary requirements for views/ comments. DPP has conveyed its comments for finalization and signing of the protocol.

USA

- Pest Risk Assessment (PRA) for grant of market access for export of fresh dates from Pakistan to USA is being finalized between DPP and APHIS/ NPPO – USA. After finalization of PRA, DPP will start exporting fresh dates to USA.
- APHIS/ NPPO – USA has allowed import of dry onion bulbs (i.e bulb with dry parchment like skin) from Pakistan.
- DPP is negotiating with APHIS for pre-clearance program to export mangoes by using the facility of Pak Electron Beam Irradiation facility, Karachi.

South Africa

- To initiate export of mango from Pakistan to South Africa, DPP has finalized technical audit of mango orchards, hot water treatment facilities and pack houses. The same have been shared with the NPPO – South Africa for virtual inspection. After video inspection of the facilities, orchards and pack houses, mango export from Pakistan to South Africa may be initiated.

Kenya

- Kenya has granted market access for import of mango and citrus from Pakistan and accordingly signed Agreements regarding conditions for importation of citrus and mango fruits from Pakistan to Kenya.

Japan

- Bilateral trade of agro-commodities with Japan is being continued smoothly. Like previous year this year too, Japan has agreed to allow mango fruits without pre-clearance programme. In 2024 Pakistan has successfully exported 44145 KGS mango.

Uzbekistan

- To finalize Pest Risk Analysis (PRA) for grant of mango export from Pakistan to Uzbekistan, DPP is compiling the requisite technical information and is being shared with NPPO – Uzbekistan. After finalization of PRA with Uzbekistan export of mango will be started.
- DPP is registering potato exporters to further enhance export of processed table potato from Pakistan to Uzbekistan. Technical Audit Committee of Quarantine Experts from Pakistan soon going to Uzbekistan for pest risk analysis of pomegranate (*Punica granatum*), plum (*Prunus domestica*), fig (*Ficus carica*), grapes (*Vitis vinifera*) , persimmon (*Diospyros kaki)* from Uzbekistan to Pakistan, so the Pakistani mission will conduct the Scientific Monitoring on pest surveillance, pest control measures, supply chain including production area, harvest, post-harvest handling, storage, processing, Quarantine treatment system, washing, grading, packaging, labeling, transportation, laboratories, quarantine inspection procedure, and phytosanitary certification system, reliable system of traceability, documentation and safe pathway.

GCC countries

- Pakistan has been exporting almost most of the agro-commodities to GCC member states by meeting their SPS requirements.

Establishment of new DPP outposts

- DPP has also set up four more outposts at Kharlachi, Ghulam Khan, Angor Adda at Pak – Afghan border, and Panjgor at Pak – Iran border to facilitate export of agro-commodities with Afghanistan and Iran.

<u>Capacity Building of traders/ stakeholders</u>

- DPP in collaboration of various departments/ organization is working for capacity building of traders/ stakeholders in compliance of WTO/ IPPC - Sanitary and Phytosanitary (SPS) regime/ International Standard for Phytosanitary Measures (ISPMs) through:

  a. Collaboration with PHDEC, Climate Change, provincial agriculture departments, All Pakistan Fruit and Vegetable Exporters, Importers and Merchants Association (PFVA) and Rice Exporters Association of Pakistan (REAP) for further enhance the export of agricultural goods.

b. Registration of Post Entry Quarantine (PEQ) station for research of new agro-commodities and for holding imported consignments of plant and plant materials, so that exotic and alien pest may not penetrate into the environment.

c. Pakistan has exporting rice to more than 150 countries, mango to more than 50 countries, citrus to more than 40 countries, potato to more than 40 countries, onion to more than 20 countries and dates to more than 25 countries.

d. DPP has conducted one-month training program to the treatment operator/ Entomologist for effective fumigation operations with Methyl bromide, Aluminum phosphide and other fumigants or quarantine treatments.

e. Provide an internship to 02 students from University of Agriculture, Tandojam.

Liaison with Pakistan Customs

- **Implementation of E-Phyto –** DPP currently is integrated with standardized Pakistan Single Window (PSW) system to replace the existing regulatory operations with paperless digital certification in order to ensure ease of doing business, reduces risk of fraudulent certificates, accuracy, sustainability and authenticity of the legal documents under the provisions of ISPM-12 of IPPC.
- Consignments of plant and plant materials being imported into Pakistan without mandatory documentation are being reshipped/ destroyed.

Activities report is attached as Annexure-A

Annexure-A

EXPORT STATISTICS OF AGRICULTURAL GOODS

Month wise Export Report From 01st July 2023 to 30th June, 2024											
Months		**Rice**	**Wheat**	**Food Grain**	**Fresh /dry Fruit & Veg.**	**Seeds and others**	**Raw Cotton**		**Cotton Products**		**Miscellaneous**
		(M.Tons)	**(M.Tons)**	**(M.Tons)**	**(M.Tons)**	**(M.Tons)**	**Bales**	**(M.Tons)**	**Bales**	**(M.Tons)**	**(M.Tons)**
1	Jul-2023	206,691.206	…..	329,366.940	114,448.679	3,669.665	…..	832.235	…..	208.217	71,837.085
2	Aug-2023	283,021.455	…..	188,757.694	130,048.964	57,634.541	…..	321.400	…..	2,703.800	162,924.456
3	Sep-2023	319,367.111	…..	16,193.810	112,683.907	91,765.699	…..	1,306.500	…..	3,649.900	110,491.306
4	Oct-2023	831,166.200	…..	730,111.900	409,416.600	91,978.200	…..	7,027.086	…..	8,884.817	182,816.400
5	Nov-2023	143,205.638	…..	353,912.048	161,249.197	47,277.581	…..	10,843.333	…..	4,887.014	233,418.080
6	Dec-2023	921,335.890	…..	301,633.070	268,047.090	9,244.415	…..	4,485.200	…..	3,778.300	201,823.010
7	Jan-2024	713,196.000	…..	135,165.000	232,275.000	1.000	…..	571.262	…..	3,177.979	231,999.759
8	Feb-2024	577,944.000	…..	148,926.000	184,380.000	0.303	…..	19.505	…..	2,843.601	176,379.591
9	Mar-2024	589,853.000	…..	140,680.000	183,315.000	62.219	…..	500.000	…..	2,776.481	200,660.300
10	Apr-2024	328,717.000	…..	76,226.660	107,254.730	80.000	…..	0.046	…..	1,169.355	146,935.209
11	May-2024	327,849.000	…..	146,264.228	165,126.057	71.111	…..	0.000	…..	430.905	141,886.699
12	Jun-2024	217,459.954	…..	131,999.708	122,092.526	94.000	…..	0.000	…..	151.267	98,787.545
	Total:	**5,459,806.454**	…..	**2,699,237.058**	**2,190,337.750**	**301,878.734**	…..	**25,906.567**	…..	**34,661.636**	**1,959,959.440**

Month wise Import Report From 01st July 2023 to 30th June, 2024											
Months		**Rice**	**Wheat**	**Food Grain**	**Fresh /dry Fruit & Veg.**	**Seeds and others**	**Cotton / Cotton Fiber**		**Raw Jute**		**Miscellaneous**
		(M.Tons)	**(M.Tons)**	**(M.Tons)**	**(M.Tons)**	**(M.Tons)**	**Bales**	**(M.Tons)**	**Bales**	**(M.Tons)**	**(M.Tons)**
1	Jul-2023	…..	0.000	278,635.440	106,121.117	4,019.946	…..	58,655.489	…..	6,938.823	23,023.765
2	Aug-2023	…..	0.000	309,569.230	52,067.200	64,346.640	…..	76,614.200	…..	4,005.200	66,871.645
3	Sep-2023	…..	162,301.000	206,903.600	51,382.800	8,348.600	…..	48,336.300	…..	1,858.300	32,601.956
4	Oct-2023	…..	381,529.500	379,748.100	284,640.200	11,679.100	…..	29,702.900	…..	3,541.600	19,089.500
5	Nov-2023	…..	522,207.500	301,303.783	189,529.136	43,691.212	…..	34,622.140	…..	4,605.524	44,345.348
6	Dec-2023	…..	286,049.600	219,342.510	173,127.370	19,403.063	…..	24,048.263	…..	3,095.048	44,386.880
7	Jan-2024	…..	562,842.617	223,876.000	100,902.000	17,701.022	…..	29,338.486	…..	1,372.454	91,475.421
8	Feb-2024	…..	851,844.548	249,204.000	84,668.000	5,330.572	…..	50,013.052	…..	1,830.956	62,050.872
9	Mar-2024	…..	722,424.040	465,294.000	104,310.000	37,659.000	…..	69,659.557	…..	2,623.527	92,694.876
10	Apr-2024	…..	81,800.000	170,775.000	38,566.000	19,031.364	…..	75,741.278	…..	3,877.375	71,355.983
11	May-2024	…..	0.000	57,740.000	19,536.000	9,244.323	…..	31,476.066	…..	1,557.977	234,113.634
12	Jun-2024	…..	0.000	143,395.000	30,797.000	3,149.029	…..	37,205.544	…..	2,414.426	132,367.001
	Total:	…..	**3,570,998.805**	**3,005,786.663**	**1,235,646.823**	**243,603.871**	…..	**565,413.275**	…..	**37,721.210**	**914,376.881**

Monthly Report Revenue 01st July, 2023 to 30th June, 2024											
Month		Release Order Issued		Phytosanitary Certificates Issued		Import Permit Issued		A.P Issued		Fine Charges	Grand Total
		Nos	Amount (Rs.)	Nos	Amount (Rs.)	Nos	Amount (Rs.)	Nos	Amount (Rs.)	Amount (Rs.)	Amount (Rs.)
1	Jul-2023	2943	14,715,000	11256	28,140,000	1278	6,390,000	333	16,650	42,500	49,304,150
2	Aug-2023	3950	19,750,000	13397	33,492,500	1927	9,635,000	465	23,250	52,500	62,953,250
3	Sep-2023	3864	19,320,000	12510	31,275,000	1728	8,640,000	201	10,050	117,500	59,362,550
4	Oct-2023	11151	55,755,000	13382	33,455,000	1870	9,350,000	201	10,050	155,000	98,725,050
5	Nov-2023	8095	40,475,000	15110	37,775,000	2066	10,330,000	140	7,000	107,500	88,694,500
6	Dec-2023	5367	26,835,000	16209	40,522,500	1934	9,670,000	163	8,150	130,000	77,165,650
7	Jan-24	3847	19,235,000	12186	30,465,000	356	1,780,000	152	7,600	0.000	51,487,600
8	Feb-24	4109	20,545,000	9776	24,440,000	1801	9,005,000	126	6,300	0.000	53,996,300
9	Mar-24	4538	22,690,000	9083	22,707,500	1801	9,005,000	282	14,100	0.000	54,416,600
10	Apr-24	3619	18,095,000	7454	18,635,000	1608	8,040,000	105	5,250	0.000	44,775,250
11	May-24	4092	20,460,000	9404	23,510,000	1687	8,435,000	491	24,550	0.000	52,429,550
12	Jun-24	3583	17,915,000	7894	19,735,000	1287	6,435,000	481	24,050	0.000	44,109,050
Total		**59158**	**295,790,000**	**137661**	**344,152,500**	**19343**	**96,715,000**	**3140**	**157,000**	**605,000**	**737,419,500**

2. REGISTRATION OF PESTICIDES:

Registration Section of this Department has registered / permitted the following pesticides under different scheme during July, 2023 – June, 2024.

SCHEME	FORM – 1	FORM – 16	FORM – 17	Total	Total Amount Collected
Registered/Permitted	134	711	506	**1351**	**96,801,000/-**
Renewal	305	1782	1041	**3128**	**89,870,600**

Registration of Formulation & Refilling / Repacking Plants:

Registration section has registered the following formulation and repacking / refilling plants during the same period.

(**It is important to note that the registration period for formulation and refilling/repacking plants through PSW registration is not included in this report.)**

SCHEME	FORMULATION PLANTS (FORM – 18A)	REFILLING / REPACKING PLANT (FORM – 19A)
Registered/Permitted fresh	11	12
Renewal	31	42
Total	**42**	**54**
Total Amount Collected	**4,751,500/-**	**2,675,600/-**

Revenue

A revenue of **Rs. 194,098,700 /- (Million. 194.0987)** was collected through treasury challans on account of registration / import permission, renewal / revised fee, and registration of formulation and repacking / refilling plants.

3. FEDERAL PESTICIDE REFERENCE AND TESTING LABORATORY:

YEARLY LAB WORKING REPORT DURING 01.07.2023 TO 30.06.2024

Month	Registered Sample Analyzed	Seaport Sample Analyzed	Sample Failed	Pesticide Granules Analyzed by PCSIR
July	15	03	0	03
Aug	05	01	0	01
Sep	06	06	0	07
Oct	60	14	0	09
Nov	46	05	0	03
Dec	42	14	0	02
Jan	26	06	02	0
Feb	13	10	0	04
Mar	50	10	0	04
Apr	32	07	0	06
May	14	10	0	01
June	23	05	0	01
Total	**332**	**91**	**02**	**41**

4. LOCUST SURVEY AND CONTROL

- **DESERT LOCUST SURVEILLANCE ACTIVITIES IN PAKISTAN 2023-24**

  The routine fortnightly desert locust surveys were carried out in Tharparkar and Nara desert in Sindh, Cholistan desert in Punjab and Balochistan from July –2023 to June, 2024.During the survey, an area of 192700 hectares was checked, where immature /mature solitary desert locust was seen in Cholistan and Tharparkar desert with a density of 6-25/ adult per hector.

- **JOINT BORDER MEETING OCTOBER, 2023**

  Only one Indo Pak joint Border Meeting was held virtually between the locustexperts of both countries to discuss the locust situation on 31-10-2023

- **FAO COMMISSION FOR CONTROLLING THE DESERT LOCUST IN SOUTH WEST ASIA**

  33rd Session of the FAO Commission for the controlling the desert locust in South West Asia was held from 18-20 December, 2023 in Rome, Italy to discuss the on desert locust, training /workshop and new technologies for locust surveillance and control.

- **DESERT LOCUST INFORMATION OFFICER WORKSHOP.**

  Desert locust information officer workshop was held from 21-22 December, 2023 in Rome, Italy to discuss the various issues of RAMSES Database elocust3m App and elocust3 tablet.

9. PLANT BREEDERS' RIGHTS REGISTRY

Pakistan has an intensive and contemporary legislation to regulate its dynamic seed industry. However, legislation regarding the protection of new plant varieties was lacking. To overcome the deficiency, Plant Breeders' Rights (PBR) Registry was established as an attached department of the Ministry of National Food Security & Research.

AIMS AND OBJECTIVES

The PBR Registry aims at encouraging the development of new crop varieties and protecting the breeders Intellectual Property Rights (IPR). It is expected to promote entrepreneurship and attract local as well as foreign investment in research and development. As enshrined in Plant Breeders' Rights Act, 2016 the Registry is mandated to:

1. Facilitate protection of new plant varieties.
2. Issue certificates under the Plant Breeder's Rights Act, 2016.
3. Ensure maintenance of the register of protected plant varieties.
4. Maintain characterization and documentation of protected varieties.
5. Promote the development of new varieties of plants.
6. Collect statistics with regard to plant varieties.
7. Take all actions necessary for its smooth functioning.

ACHIVEMENTS/ACTIVITIES OF PBRR

1. PLANT VARIETY PROTECTION

The Registry has started receiving the applications for plant variety protection since February 15, 2021.

Details of plant variety protection related activities during the Financial Year 2023-24are as under:

Sr. No	Activity	Quantity
1	New applications received	29
2	Cases opened for opposition	36
3	PVP certificates issued	15
4	Cases closed	14
5	PBR journal publication	03

Distribution of Plant Variety Protection (PVP) certificates to the representative of multinational company by Secretary MNFS&R

Distribution of Plant Variety Protection (PVP) certificates to the breeders of national private sector by Secretary MNFS&**R**

Distribution of Plant Variety Protection (PVP) certificates to the breeders of national public sector by Secretary

MNFS&R

2. SCOPE OF PROTECTABLE CROPS

The Plant Variety Protection scope was limited to only two crops (maize, cotton) at the initial stage. During the Financial Year 2023-2024, the list of protectable plant species was extended to the following crops.

S.No.	NameOfCropGroup	NameOfCrops
1	**CerealCrops**	**Wheat***(Triticumaestivum)*,**Rice***(Oryzasativa)*, **Maize,***(Zeamays)*,**Barley***(Hordeumvulgare)*,**Millet***(Penniseluni glaucum)*, **Sorghum** *(Sorghumbicolor)*,**Oats***(Avenasativa)*,
2	**FiberCrop**	**Cotton***(Gossypium.*spp)
3	**VegetableCrops**	**Tomato***(Solanumlycopersicum)*,**Potato***(Solanum tuberosum)*,**Onion***(Alliumcepa)*,**Peas***(Pisumsativum)*,**Garlic***(Alliumsativum)*,**Chili***(Capsicum anum)*,**Cucumber***(cucumussativus)*
4	**PulsesCrops**	**Chickpea***(Cicerarietinum)*,**Mungbean***(Vigna radiata)*,**Lentil***(Lensculinaris)*
5	**FruitCrops**	**Banana***(Musaacuminata)*,**Citrus***(Citrus*spp), **Date Palm** *(Phoenix dactylifera)*, **Peach** *(Prunus persica)*, **Pear** *(Pyrus pyrifolia)*, **Mango** (Mangifera indica)
6	**OilSeedCrops**	**Canola***(Brassicanapus)*,**Sunflower***(Helianthus annus)*,**Groundnut***(Arachishypogea)*,**Rapeseed** *(Brassicanapus)*,**Olive***(Oleaeuropea)*,**Sesame** *(Sesamumindicum)*

7	**Sugar Crops**	**Sugarcane***(Saccharumofjicinarum)*
8	**FodderCrops**	**Ryegrass***(Lolium perenne)*

3. ESTABLISHMENT OF PLANT VARIETY PROTECTION ADVISORY COMMITTEE

Plant Variety Protection Advisory Committee was constituted according toarticle 10 of Plant Breeders' Rights Act 2016 consisting of a convener,PBRR officials, nominees of public sectors from each province and private sector stakeholders.

4. NATIONAL COLLABORATION

For strengthening of DUS examination, PBRR is working in collaboration with Federal Seed Certification & Registration Department (FSC&RD). Furthermore, PBRR is working with Academica for dissemination of information regarding Plant breeders' rights, farmers rights and community rights. The PBR Registry remained involved in the generation of morphological as well as molecular database of existing plant varieties.

5. INTERNATIONAL COLLABORATION

For the seed sector development in Pakistan, PBRR remained in contact with International Union for the Protection of New Varieties of Plants (UPOV) for attaining the status of member state. This membership will open new endeavors for seed exports of Pakistan.

6. DEVELOPMENT OF OFFICIAL WEBSITE

To facilitate the breeders and to contribute towards ease of doing business, the PBR Registry has developed official website (https://pbrr.gov.pk/). Furthermore, the cases of potential applicants are placed on PBR Registry's website for the opposition in addition to publication in press.

7. PLANT VARIETY REGISTRATION LABORATORY

Plant Breeders' Rights Registry and FSC&RD working in collaboration over functionalization of PVR laboratory. In the initial phase, optimization of DNA fingerprinting/barcoding of maize and paddy crop is under progress.

11. PAKISTAN OILSEED DEPARTMENT (POD)

Pakistan Oilseed Department (POD) is a Sub-Ordinate office of M/o National Food Security and Research (NFS&R). Presently it is working at federal level for promotion of oilseed crops and olive cultivation. Major activities of POD during 2023-24 are as under:

MAJOR ACTIVITIES FOR THE YEAR 2023-24:

POD's experts participated in the following technical meetings/trainings session arranged by the M/o National Food Security & Research.

- POD in consultation with all provinces prepared the working paper on Oilseed crops viz Canola, Sunflower and Rapeseed & Mustard and presented in the Federal Committee on Agriculture (FCA) meetings on Rabi and Kharif seasons 2023-24.
- Promoted, in collaboration with Provincial Governments, oilseed crops and oil yielding plants in the country to substitute the import of edible oil.
- Collected, compiled and maintained statistics in National and International oilseed sector.
- Progress review of oilseed promotion activities and future strategies.
- Contributed in the completion of Pakistan Economic Survey 2023-24 on oilseed crops.
- Awareness campaigns regarding sunflower, canola and olive cultivation were carried out at different locations for promotion of these crops.
- Technical team of Pakistan Oilseed Department actively participated in the meeting titled "Consultative Session for Promotion of Indigenous Edible Oilseed Crops and promotion of Soybean Cultivation in Punjab" dated 05-06-2024 in the Auditorium of Agriculture House, 21Davis Road, Lahore.
- Concept papers and then PC-I prepared for promotion of Soybean and Sesame in the country.
- Managing Director (POD) chaired internal meeting of new project Olive Culture on 20-03-2024 with Italians.

PROPOSED NATIONAL OILSEED POLICY

To address the issue of our dependence on imports of edible oils in the long run Federal Government constituted a committee under the chairmanship of Dr. Muhammad Jahanzeb Khan, Special Assistant to Prime Minister (SAPM) for Government Effectiveness including all stakeholders of oilseed sector for deliberation on policy framework. Accordingly, the Pakistan Oilseed Department, Ministry of National Food Security and Research has prepared a first ever comprehensive draft National Oilseed Policy to attain self-sufficiency in edible oil for 70% of country's requirements in 2034 by locally producing more than 4.441 million tons edible oils. In monetary terms there would be an import substitution of US$7.611 billion per annum by 2034.

MAJOR CHALLENGES

- High import bill of edible oils and oilseeds US$ 5,039 billion during 2022-23. Local production share was 12% in total requirement of 4.275 million tons of edible oils.
- Low imports duties on import of edible oils and oilseeds which are stagnant for the last 23 years, which encourage imports of edible oils and oilseed over local production.
- Lack of preparedness to confront this challenge as POD established to promote oilseed crops and oil bearing trees in the country has squeezed to Federal Area only after 18th amendment.
- Lack of locally produced area-specific high yielding varieties/hybrids of oilseed crops.
- Lack of mechanization which is hampering productivity in oilseeds.
- No minimum intervention prices and ensured procurement mechanism.

RECOMMENDATION/ POTENTIAL REMEDIES

- Minimum intervention prices (MIP) for oilseeds may be announced on the basis of their cost of production before start of season.
- RD onimports of edible oils and oilseeds may be imposed to ensure MIP.

- Research and Development may be supported for development of area specific high yielding varieties/ hybrids of oilseed crops and improved production technology.
- Draft National Oilseed Policy may be approved for its implementation to make country self-sufficient for 70% of its requirement of edible oils by 2033-34.

Two mega projects titled "National Oilseed Enhancement Program" and "Promotion of Olive Cultivation on Commercial Scale in Pakistan Phase-II" are in progress.

Area and Production of oilseed crops during 2023-24

ACTIVITIES OF "NATIONAL OILSEED ENHANCEMENT PROGRAM" (NOEP)

Targets for the FY- (2023-2024) in acres.

Area: '000' Acres Production: '000' Tons

No.	Particulars	Punjab		Sindh*		KP		Balochistan	
		Targets	Achiev: (Verified vouchers)	Targets	Achiev:	Targets	Achiev:	Targets	Achiev:
1.	**Subsidy on seed**								
	Canola	83,542	101,449	23,000	00	10,000	4,670	20,000	12,330
	Sunflower	79,449	154,209	140,000	00	5,000	543	20,000	00
	Sesame	144,000	Crop in field	13,000	00	1,500	245	11,000	9,633
	Total	**306,991**	**255,658**	**176,000**	**00**	**16,500**	**5,458**	**51,000**	**21,963**

*Sindh component has not come on board (1st estimates of achievements 2023-24)

- The focal Person for Punjab, KPK and Balochistan regularly monitored the canola sunflower and sesame crop fields under NOEP project.

National Oilseed Enhancement Programme activities at a glance.

Year	2022-23		2023-24	
Crops	**Area**	**Production**	**Area**	**Production**
Rapeseed- Mustard	1332	675	850.8	415.738
Sunflower	187	133	155	98
Canola	205	141	108.51	71.71
Total	**1,724**	**949**	**1114.31**	**531.448**

Monitoring team visit to the sunflower field in Punjab

Monitoring team visit to the Canola and Sesame field in Punjab

Field visit of soybean in Sahiwal and Faisalabad Districts.

Promotion of olive cultivation on commercial scale in Pakistan Phase-II

Physical Progress (2023-24)

Activities (2023-24)	2023-24		
	Target	Achieved	%age %age
Plantation	6500	4,815	74
Drip Irrigation System	700	700	100
Recruitment of project's staff	-	0	0
Trainings	44	46	100
Plant Propagation	1.095	0.782	71
Adaptability Trials	21	21	100
Fruit processing Units	0	0	0
Equip. for certification labs	-	-	-
Nursery infrastructure (50:50)	-	-	-
Grafting of wild olive (m)	0.3	0.069	14
Overall Progress %			**77%**

MAJOR ACTIVITIES 2023-24

1. Olive Plantation:

As per available demand and budget, 650,000 local certified olive nursery plants procured including ***Arbequina, Koraneiki, BARI Zatoon-I, BARI Zatoon-II, Arbosona, Gemlik, Ottobratica, Chemlali, Picholine, jerboui, earlik, Ascolana, Manzalinna, Cheitina***varieties**.**

This year major share of olive plants 63% (413,491 plants) was provided to Balochistan which shows the interest of Balochistan's farmers in olive farming followed by KP 10 % (67,100), Punjab 60,000, Sindh 40,000, AJK 38,409, Federal 20,000 and GB 11,000. Overall, 4,814 acres have been brought under olive cultivation across the country on public and private lands.

2. Installation of Drip Irrigation System:

Development of efficient water saving technologies for culturable waste land is also the mandate of the project. For this propose, during 2023-24 drip irrigation system was installed on 700 acres under the project at 47 on public & private olive farms in Balochistan, Khyber Pakhtunkhwa, AJK and Punjab.

3. Capacity Building/ Seminars/Trainings

In current year 2023-24, about 44 trainings on Olive cultivation, Orchard and Nursery Management, value addition, oil processing and other aspects were conducted under the project for capacity building of olive growers and farmers at different project collaborating units. These trainings were meant for the capacity building of the farmers, stakeholders, gender, and youth. A total of 2550 participants (average 58 participants/training) including women, attended these trainings. Moreover, for awareness about olive cultivation and its value-added products, 02 days National Olive Gala, was organized in Islamabad in which public shows keen interest in extra virgin olive oil and other value-added products. One-day 4th International Olive Conference on "Olive Culture: Combating Climate Change Strengthening Value Chain through Youth Award" was organized at Loralai Balochistan and a National seminar was organized in Rawalakot, Azad Jammu and Kashmir.

Geo mapping of Drip Irrigation site

i. Pak Olive National Gala 2023 (5th Olive Festival)

To celebrate World Olive Tree Day "Pak Olive National Gala" was organized at F-9 Park, Islamabad on 25th – 26th November 2023 to showcase the success story of olive sector development in Pakistan and to spread awareness about healthy and quality olive oil and its other value-added products to the public. On this occasion PakOlive National Brand was also launched. Dr. Kausar Abdullah Malik, Federal Minister, Ministry of National Food Security & Research graced the occasion with his presence as chief guest and inaugurated the National Gala. He reiterated the commitment of Pakistani communities towards the promotion of Olive production. This is not only enhancing olive production but also providing income opportunities to communities, especially women and youth. He also stressed the need for an adequate policy that supports the rural development of the olive sector.

On the second day of the Pak olive National Gala "World Olive Tree Day Walk" was organized. People from various disciplines participated in the walk and appreciated the efforts of the government in the development of the olive sector. Moreover, to encourage the olive farmers/ olive oil producers a competition was also organized during the event later on certificates were distributed to the progressive farmers.

ii. 4th International Conference:

One day international conference on "Olive Culture: Combating Climate Change Strengthening Value Chain through Youth Award" held on 10th June 2024 at University of Loralai, Balochistan jointly

organized by PSDP olive project and University of Loralai Balochistan. The participation of various national and international R&D organizations adds significance to this important gathering.


iii. International Seminar:

A National Seminar on "Present Scenario and prospects in Azad Jammu Kashmir" was organized on 7th June 2024 in Collaboration with Department of PBMG, Faculty of Agriculture, University of Poonch, Rawalakot at university of Poonch, Azad Jammu & Kashmir. Large number of students and faculty member attended the seminar.

4. <u>Preparation of HACCP Manuals:</u>

Manuals regrading HACCP has been prepared in collaboration with Italian Olive*Culture* project. The manuals have been handed over to the National Project Director by International Coordinator, Olive*Culture* project Mr. Marco Marchetti.

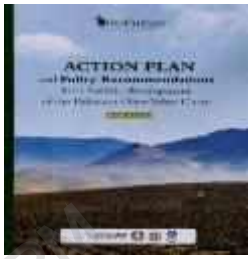
5. <u>Establishment of Olive oil quality analysis Laboratories:</u>

With the advancement of olive sector in Pakistan, a coordinated approach towards the standardization, branding, HACCP and quality regulation is very much required for better marketing and exports in near future. For this purpose, a reference laboratory for olive oil quality has been established at Islamabad in coordination with experts from CIHEAM BARI, Italy. This laboratory is ISO 17025 accredited according to the standards of International Olive Council.


6. <u>Olive policy making:</u>

There is a pressing need to establish an autonomous body like Pakistan Olive Oil Council/ Association in order to regulate and govern the newly emerged sector on sustainable basis, which will oversee the quality aspects, true labeling, good manufacturing practices, certification cover, developing linkages between growers, processors, international organizations, policy framework and public private partnership for olive sector development in Pakistan.

To achieve the result of an adequate policy support for the rural development of the olive sector, a stakeholder group has been appointed to be the core of the Pakistan Olive Oil Council (POOC) and to be stablished in the near future, to carry out the activity "Drafting of an Action Plan and Policy Recommendations for a holistic development of the Pakistani Olive Value Chain" (AP&PR), which is of paramount importance, as it provides innovative and creative insights to attain the stated objectives by highlighting the challenges and prospects of Pakistan's burgeoning olive sector. A logo of Pakistan Olive Oil Council has been designed and advisory proposed.



7. Value addition activities:

Value addition is the key for the successful introduction of a crop. For this purpose, as a demonstration to olive farmers various products are being prepared under project.

Various edible and cosmetic products have been prepared at federal project management unit under the guidance of National Project Director i.e. Olive pickle, olive Murabba, roasted olives, olive leaf tea with blend of different ingredients, olive bam, olive moisturizing soup and hand washes and flaks for keeping olive oil fresh and easy to use.

8. Adaptability Trials

To examine the performance of various varieties in different Agro-climatic areas 21 adaptability trials have been planted this year. Variety wise data will be collected for morphological traits and oil quality parameters to assert the adaptability of olive in those areas.

9. Indigenous plants propagation

During FY 2022-23, 782,332 cuttings were planted by different project components for propagation of true to type, disease free olive nursery plants.

10. Formulation of Olive dashboard

A dashboard for olive crops has been developed.

11. AGRICULTURE POLICY INSTITUTE (API)

Agriculture Policy Institute (API) is an attached department of MNFS&R and mainly deals with analysis of emerging policy issues in agriculture sector. On the evolving of WTO Regime and Regional Trade Agreements in place, the country needed to know/monitor the development of tradable commodities both domestically and internationally and suggest steps to position the Pakistan Agriculture in the emerging environment scenario. To advise the Government on formulating agriculture policy and to make Pakistani agriculture profitable, competitive and sustainable, the Government of Pakistan extended its role in Agriculture Sector and reconstituted APCom as "Agriculture Policy Institute (API) in December, 2006. The mandate of Agriculture Policy Institute is as under:

Mandate of API

The functions of Agriculture Policy Institute are as under:-

i. The focus will be broader on agriculture policies. Focus will be general and adjustable keeping in view growing needs.
ii. Conduct studies on emerging policy issues. Periodically examine, processing, storage and marketing costs of agricultural commodities and recommend policies and programs to reduce such costs and improve the competitiveness of commodities. Broader coverage and holistic approach.
iii. Analyze the impact of important agricultural policies ongroups such as consumers, processors and exporters and advise on policy adjustments needed for greater efficiency and equity.

1. ACHIEVEMENT / PERFORMANCE DURING FINANCIAL YEAR 2022-23

The list of key functions carried out is as following:

i. Provided Technical input for determination of Support Price of Wheat for 2022-23 Crops.
ii. Provided technical input for determination of intervention price of Seed Cotton.
iii. Prepared Annual Policy Analysis Reports on Cotton, Sugarcane, Rice and Wheat for 2022-23 crops.
iv. Attended regular sessions of the Senate / National Assembly and assisted the NFS&R to respond to the Senate / National Assembly Questions.
v. Assisted the NFS&R on matters related to Sugar Advisory Board and Controller General Prices & Supplies.
vi. Assisted the NFS&R on analysis of Food Security Issues and technical input as Briefs / Comments on various Issues /studies/ papers/letters etc.
vii. Provided technical input for the bilateral Trade, WTO Agreements and other trade related issues.

viii. Assisted M/o NFS&R on preparation of Annual Report on Food Supplies Committee on Defence Planning.
ix. Organized consultation meetings with growers / Associations, Provinces and Agricultural Research Organizations for Price Policy Analysis of major crops.
x. Provided technical input to Pakistan Citizen Portal (PMDU) complaints and PMDU special tasks.
xi. Provided input to National Oilseed Policy.

2. Processing of Surveys Data

- Field Survey data was processed to update Cost of Production estimates for the following major crops:
  i. Wheat, (Punjab & Sindh,
  ii. Cotton (Punjab and Sindh), and
  iii. Rice (Punjab and Sindh).

3. International Trade

- Analysis of International Trade related to agriculture
- Meeting with International Agencies/Ministries/Provincial Departments

4. Special Assignment

- Provide inputs to Federal Committee on Agriculture (FCA) on various crops in Rabi and Kharif Seasons.
- Prepared draft report on Food Supply Committee on Defence Planning
- Coordinated meeting of Food Supply Committee on Defence Planning
- Provided input to Provinces / Ministries / Departments on various official maters / emerging Policy issues.

12. PAKISTAN AGRICULTURAL RESEARCH CENTRE (PARC)

Pakistan Agricultural Research Council (PARC) is the apex national organization working in close collaboration with other federal and provincial institutions in the country to provide science based solutions to agriculture of Pakistan through its statutory functions.

PLANT SCIENES

Wheat Program, CSI, NARC

Objective

The main focus of the Wheat Program is productivity improvement through crop improvement and crop management in Wheat.

Genetic Improvement/Crop improvement

Germplasm development/hybridization: About 725 diverse cross combinations were developed.1275 populations at different filial generations (F1-F6) were planted and about 1012 desirable populations were selected About 1471 F7 head rows were planted and 771 were selected. As result about 770 genetically stable new genotypes were developed and were included in breeding program.

Evaluation of elite lines: About 3000 genotypes of exotic germplasm and 576 wheat lines were evaluated at station and regional yield rials and 2886 elite lines were selected. Based on performance 16 advance bread wheat lines were provided for testing against different diseases in National Wheat Diseases Screening Nursery (NWDSN). 02 bread wheat lines were sent to FSC&RD for DUS study and 13 advance lines were contributed to the Provincial Uniform Wheat Yield Trials in the different provinces. As result, 05 advance bread wheat

lines were contributed for testing in the National Uniform Wheat Trials (NUWYT). Two advance lines (NR 683 and NR 682) performed well in first year of NUWYT and got first and 8th position at Pakistan level under rain fed conditions. These lines will be released as varieties next year.

Speed breeding: Pakistan's first Speed Breeding facility rapidly developed more than 1000 new wheat lines for future wheat varieties. To fast-track the development of more productive and climate-resilient wheat varieties, PARC has established a new speed-breeding facility at the Wheat Programme NARC, Islamabad. Through this facility, we have advanced 310 wheat populations from F0 to F6 generations rapidly. These wheat generations just took 12 to 14 months from the first filial generation to the sixth filial generation through this speed breeding facility, otherwise, they take 6 years in the field. Rapidly developed 800 wheat lines through this technology having different valuable traits are now under field trials for evaluation and selection.

CROP MANAGEMENT

Development of Production Technologies

10 different types of crop management experiments were conducted during crop season 2023-24, to find out the most suitable planting window, planting density, optimum fertilizers levels, Biochar, Effect of Mg, Climate Smart Agriculture, Seed Production of latest wheat cultivars, dissemination and popularization of wheat varieties at the farmer's fields, Foliar application of Urea and conservation agriculture etc. to find out the best management practices. Wheat planting during the first week of November had maximum Grain yield (7871 kg/ha) in comparison with the last week of December (2610 kg/ha). Moreover, Maximum Grain yield (3134 kg/ha) was recorded with seed rate 100 kg/ha.

Dissemination of improved varieties and Production technology:

During crop season 2023-24, under various projects 222 demonstration plots were planted on farmer fields/ research centres throughout the country. It's worth mentioning here that in demonstration plots of different wheat varieties, PARC-Wheat varieties performed exceptionally good at the farmer's fields especially in rain fed plateau of Pothowar. Zincol 16 produced 85 mounds/acre under soybean-wheat cropping system. Zincol 16 gave 48 mounds/acre and stood First in Jhelum district (Wheat Yield Competition carried out by Punjab Agri Extension Department). There was mung-wheat based cropping system. Markaz 19 produced 45 and 44 mounds/acre and stood at 2nd and 3rd positions in above district in Wheat Yield Competition carried out by Punjab Agri Extension Department). There was sesbania-wheat based cropping system in the area.

Human Resource Development:

During crop season 2023-24, 10 Field Days / Trainings were conducted and about 1125 farmers and as well as staff of Agriculture Extension Department were trained

Quality Seed Production

During 2023-24 about 365 tons of wheat seed of different categories was distributed among 30 public/ private seed companies and farmers. During this cropping season 2023-24 about 330 tons of seed has been produced and is expected to be available for the next cropping season (2024-25).

Fig.1. Hybridization

Fig.2. Hybridization in Speed Breeding facility

Pulses Research Program, CSI, NARC

Genetic Improvement

- Two new varieties of Lentil (NARC Lentil 24) and Mung bean (NARC Mung 24) have been recommended from VEC for approval from seed councils in the 2nd meeting of the Pulses VEC held on April 16, 2024 at PARC. The proposals for the approval from seed councils are being prepared.
- Two advance lines of Lentil (LS-21-01 and LS-21-02) completed 2 years of NUYT and DUS and DNA fingerprinting and the case is being prepared for recommendation from upcoming Pulses VEC.

Fig.3. NARC Lentil 24
- Multiple disease resistance
- Lodging and shattering resistance
- 140-145 Days to Maturity

Fig.4. NARC Mung 24
- Tolerant to MYMV and CLS
- Bold and Shiny green seeded
- Top fruit bearing

Crop	Germplasm evaluation	Cross Combinations	Advancement Filial Generation	On station trials	Multilocation trials	Identified disease resistant genotypes
Chickpea	160	6	92	8	2	11
Lentil	172	4	60	8	2	20
Mung bean	389	5	28	5	0	21
Mash	215	5	25	7	1	50
Faba Bean	50	-	-	3	0	0
Kidney Bean	75	-	-	2	0	0
Cowpea	11	-	-	1	0	0

Production Technology Improvement

Crop	Trials for Technology Improvement	Demonstration plots	Field days/seminars
Chickpea	1	19	2
Lentil	2	17	1
Mung bean	2	20	2
Mash	3	16	2

- In Pothwar conditions, Abbas Mung outperformed other recent varieties, including (NM-21, NM-11, NM-16, AZRI-21 and Jumbo Mung).
- 25 kg/ha seed rate along with 30 cm row spacing for mash candidate line (NMS-21-02) may be recommended for getting its higher production in Pothwar conditions.
- Osmopriming of KCL 0.2% to 0.4% from 2 and 4 hours showed positive effect on growth and yield rather than hydropriming for 2,4 or 6 hours in Mung bean and Mash bean.
- 800ml/acre dose of bio stimulant when applied after 60 DAS or 70DAS improves the yield as compared to no spray and bio stimulant application @ 400 and 600 ml/acre in Lentil.

Quality Seed Produced and Sold

	Mung bean	Mash	Chickpea	Lentil	Total
Seed Produced (kg)	1800	835	1600	710	**4,945**
Seed sold (kg)	1528	4	283	247	**2,062**

Human Resource Development

Eight students of BSc. (Hons) agriculture from different universities completed their internship research and report.

Developmental Projects

Sr. #	Title of project	Source of funding	Status
1	Promoting research for productivity enhancement in Pulses	PSDP	On-going
2	Development of climate smart mash and mung bean genotypes with better plant type and higher yield through intra and inter specific hybridization.	ALP	On-going
3	Increasing productivity and profitability of pulses in cereal-based cropping systems in Pakistan	ACIAR (MoU)	Completed

Maize, Sorghum & Millet Program, CSI, NARC

1. **Evaluation of maize Inbreed lines & generation advancement:** During Autumn 2023, 470 inbred lines were evaluated, and generations were advanced. Twenty-seven distinct maize inbred lines were assessed for heat stress tolerance. The genetic analysis of kernel oil and protein contents in 20 climate-resilient maize genotypes was conducted.
2. **Development and evaluation of new hybrid/OPV combinations of maize:** A total of 180 new hybrid cross combinations were developed, and in the Preliminary Yield Trials (PYT), 125 hybrids were evaluated. The most promising hybrids were selected for further testing.The 25 heat tolerant hybrids developed during spring season were evaluated and GY also experienced a significant drop under heat stress, with mean values ranging from 5.1 to 174.7 g compared to control conditions of 14.2 to 220.9 g. This was attributed to the expressed heat stress on secondary attributes.
3. **Acquisition and evaluation of Pearl, Proso and Foxtail millet germplasm**: Hundred genotypes of pearl millet were acquired from the PGRI Gene Bank and rejuvenated. Most of the genotypes lodged and showed poor seed setting. During the reporting period 29 more proso millet genotypes were obtained from PGRI and were subsequently planted in the PGRI glasshouse in collaboration with Director PGRI. Among the 29 newly acquired genotypes, 2 were identified as foxtail, and two were not germinated. In

the same season 50 foxtail millet genotypes were rejuvenated and 19 showed no germination. Out of 50 foxtail genotypes 09were observed as proso millet genotypes. The rejuvenation process revealed that the highest seed viability of foxtail millets in the glasshouse was observed in accessions 33 and 35, each with 68 and 62 plants respectively.

4. **Acquisition and evaluation of Sorghum germplasmand Sorghum Agronomic Trials:** One hundred sorghum genotypes were acquired for PGRI and subsequently rejuvenated. Seed germination rates were very low, with only 1-2 plants per genotype germinating. The seeds will be multiplied, and the most promising genotypes will be utilized in the breeding program. Two agronomic trials were conducted on sorghum to determine optimal plant population and fertilizer requirements for the NARC-S1 sorghum candidate variety. The optimal plant spacing was found to be 8 inches, and the best results were achieved with a fertilizer application of two bags of urea and 1.5 bags of DAP.
5. **Optimization of DH laboratory growth chamber and Isolation Facilities:** The experiment aimed to evaluate the germination and seedling growth of maize (both inbred lines and OPVs) under normal light and grow lights, as well as the performance of maize in four different growing media treatments: 100% peat moss, 100% soil, 70% soil + 20% FYM + 10% sand, and 70% soil + 30% FYM. The study concluded that normal light with lower lux values leads to etiolation, which can be mitigated by increasing the lux value. Although grow lights are expensive, they resulted in higher overall dry matter accumulation. Additionally, two inbred lines were multiplied in isolation structures, and suggested changes were noted.
6. **NUYT Evaluation:** During autumn season 2023, three maize NUYT trials (Hybrid 1st year (111 entries), 2nd year (180 entries) and OPV (04 entries) and One sorghum trial (19 entries) and 1 millet trail (69 entries) were evaluated. During Spring 2024, MSM program received three trials from the National Coordinator MSF&OC i.e. Maize Hybrid 1st year (45 entries), Maize Hybrid 2nd year (81 entries) and Maize OPVs (4 entries) trial. Data of various parameters i.e., phenological, agronomic (plant and cob height) and yield related traits collected and handed over to National Coordinator MSMF&OC.
7. **Students Supervised**
   PhD Students = 02
   M.Sc. Students= 04
   Internees= 10
8. **Research Paper published**
   Published five research papers

Fig.5. Haq Nawaz Gold a Maize

Fig.6.NARC POPs a Maize Variety

Fodder & Forage Program, CSI, NARC

Objective:

Research for productivity enhancement of fodder crops to fulfill the Fodder requirement of livestock in Pakistan.

Achievements/ Progress.

- Germplasm evaluation, purification and seed multiplication of sorghum (120 line); Millet (180 lines); Oats (170 lines); Sudan grass (21 lines); Barley (34 lines); Vetch (13 lines); Cowpea (30 lines); Maize (50 lines)
- Selection and evaluation of 48 oat genotypes on the basis of green fodder yield, lodging resistance, stay green characteristics (late maturing)
- Started breeding and variety/hybrid development in Cowpea, Maize and Sorghum-Sudan Grass
- Conducted trails for evaluation of different ratios of oat:vetch mixed cropping for enhanced fodder productivity
- Refined production technology of six major fodder crops (oat, vetch, mott grass, maize, Sorghum and millet)
- Six oat, five ryegrass, four vetch and four millet advance lines were contributed in National Uniform Fodder Yield Trials (NUFYT)
- Two year Distinctness, Uniformity and stability (DUS) examination of VEC approved oat line "PARC-Oat" has been successfully completed
- DNA profiling and quality analysis of five advance ryegrass entries is in progress
- Ninety tons of quality seed of Oat approved varieties was produced from 115 acres.
- Facilitated research of 02 M.Sc and 08 BSC students on various fodder crops.
- Conducted demo plots of Oat, Vetch, Sorghum, Maize, Millet and Mott grass in Punjab, Sindh, Baluchistan, AJ&K and KPK
- Conducted 03 farmer trainings for improved fodder production technologies at three different locations in Punjab, KPK and Islamabad with participation of 200 farmers
- Received an MoU project between Fodder & Forage Program with KOPIA titled "Dissemination of improved fodder production technology and village base seed enterprise through farmer's participatory approach in Pakistan: awareness campaign and capacity building"
- Project submitted under ALP 10th batch titled "Establishment of Advanced Production Technology of Fodder Oats to get Potential Green Fodder Yield for amplified fodder Production in changing climate scenario"; has been shortlisted after initial scrutiny and evaluation
- Submitted three projects under the PSF, National Sciences Linkages Program and PSDP

			
Fig.7. Sorghum	**Fig.8.**Ryegrass trails	**Fig.9.**NUFYT trials	**Fig.10.**Farmer trainings

<u>Rice Research Program, CSI, NARC</u>

Salient Achievements/Success Story

- A set of 78 rice lines was acquired from PGRI-BCI NARC and was evaluated for morpho-physiological, agronomic traits and disease reaction.
- Three stable lines were selected for contribution in the NUYT and micro-trials.
- NARC Rice-1 variety was approved by VEC held on 28-03-2024.
- A total of six advanced (lines three in the first year and three in the second year) were contributed in the NUYT-2023-24for yield stability, disease, and insect screening.

Fig.11. Molecular evaluation of Rice Germplasm (XA 21 marker on Advance GSR Lines; XA 07 marker on Advance GSR Lines

Fig.12. Rice Transplantation at beds

Table.1 Characteristics of new Rice Variety

Parameter	NARC Rice-1
Plant Height	115cm
Maturity Duration	110 days
Tillers/Plant	24-27
Grains/Panicle	240-260
Kernel Length	7.4
HR Recovery	58-60%
Response to BLB	MR
Yield Potential	tons/ha

Breeding and Yield Trials

- Genetic Resources and Field Characterization: Planted 78 rice accessions from PGRP, BCI, NARC, and Islamabad; increased seed for next year's evaluation.
- Hybridization and Generation Advancement: Developed new combinations with traits like high yield and BLB resistance; raised and advanced various filial generations (F1 to F4); performed marker-assisted selection.
- Hybrid Development: Conducted TGMS line development and crossed 25 GSR lines with TGMS source genotype, achieving 26 successful cross-combinations.
- Yield Trials of Rice: Conducted advanced yield trial (AYT) with 24 lines and preliminary yield trial (PYT) with 53 lines using RCBD and Alpha lattice designs. Evaluated multi-location yield trial with 25 lines across eight locations. Identified 12 top-performing genotypes from AYT for final station evaluation; advanced 6 lines to National Uniform Yield Trial (NUYT).
- Evaluation of Coarse, Fine, & Hybrid Rice Genotypes: Evaluated 131 rice hybrids, 43 fine, and 20 coarse rice lines in National Uniform Yield Trial (NUYT) with 3 replications. Recorded data on yield performance, and agronomic traits, and shared results with National Rice Coordination.

Other Agronomic Research Trials

- Genetic Evaluation and Agronomic Interventions for Improving Grain Micronutrient Contents: Evaluated

six advanced coarse rice lines with different ZnSO4 treatments for agronomic biofortification. T2 (foliar application of 0.5% ZnSO4 at panicle initiation & grain filling stage) showed the highest zinc concentration in rice grains (54.6 ppm). Genotype NRP-5 exhibited the highest average Zn concentration (34 ppm), with notable performance also seen in NRP-6, NRP-4, and NRP-3.

- Comparative Analysis of Cultivar-Specific Responses to Varied Nursery Sowing and Transplanting Dates: Investigated five rice lines with different sowing dates: May 28, June 8, and June 18. The highest yield was achieved on the first sowing date, with NRP-5 showing the maximum yield of 3982 kg/acre. The lowest yield was recorded on the third sowing date, with NRP-3 yielding 3392 kg/acre.
- Effect of Different Seed Rates on Yield and Yield Components of Coarse Rice: Studied five rice lines with seed rates of 4, 5, 6, and 7 plants per square meter. The highest yield was observed with 5 plants per square meter (4282 kg/acre) in NRP-5. The lowest yield was with 4 plants per square meter, and NRP-3 yielded 3972 kg/acre.
- Development of Submergence/Flood Tolerant Rice Lines: Evaluated 10 rice genotypes under controlled flood conditions using three treatments (control, ethylene-treated submerged, untreated submerged). Identified six submergence-tolerant genotypes (GSR-5,GSR-61, GSR-13, GSR-2, GSR-4, and Chenab basmati) using SSR marker-based genotyping.
- Insights into the Impacts of Partial Replacement of Nitrogen Inputs on Grain Yield and Nitrogen-Use Efficiency: Explored different N sources (synthetic, synthetic + manure, synthetic + compost) in six high-yielding NUYT coarse rice genotypes. Aimed to improve N-absorption, N-use efficiency, and grain yield through varying N-application rates and mixed N sources. Co-application of organic and synthetic fertilizers significantly improved N use efficiency, grain yield, soil fertility, and crop performance compared to sole urea application. This approach enhanced plant growth, root-shoot ratios, seed-setting rates, and rice grain quality traits like protein and amylose content.

Human Resource Development

10 students of B. Sc. (Hons) Agriculture from different universities completed their internship research and report, while currently, 21 internship students alongside with one M. Sc. (Hons) student from Punjab and Baluchistan Universities are doing their research and internship.

Developmental Projects

S. No.	Title of project	Source of funding	Status
1.	Productivity Enhancement of Rice (Rice Program, CSI Component)	PSDP	On-going

Samira Ameen
RO (EC-II)
Tuesday, 04 February, 2025, 4:33:58 PM

Oilseeds Program, CSI, NARC

Inbred line development, maintenance and purification:

During 2023-24, a total of around 126 inbred lines arein different developmental stages and 61 inbred lines (A, B and R) were maintained, purified and seed replenished.

Genetic homogeneity enhancement work on the inbred lines (A, B &R) of SMH-1900J was successfullycompleted and was submitted at VEC. In total, 30 new hybrid combinations were using different CMS and R lines.

During spring 2023, nineteen NARC-Developed local sunflower hybrids were evaluated and all out-yielded the check hybrid Hysun-33 (2491 kg/ha). Maximum seed yield was produced by A-S11-85XR-S11-65 (3179 kg/ha)followed by SHAMS-37 (A) SPS-3 (S10)X R-S-10-85 (3145), SHAMS-37 (A) SPS-3 (S11)XRHA-71-SPS(1)(3055), A-S10-77 X R-S11-65 (2929) and SHAMS-37(A)-SPS-3(S11) X R-S10-83(1) (2921 kg/ha in NationalUniform Yield Trials spring 2023, a total of 39 sunflower hybrids, including Hysun-33 used as check, were evaluatedat 13 different locations.

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- Sunflower hybrid SMH-1900 J developed by NARC scientists submitted to PARC Variety Evaluation Committee for recommendations in 2024
- Sunflower hybrid NARC-SUN-2020 developed by NARC scientists submitted to PBR for patent protection
- NARC-developed two Sesame varieties PARC-Til and NARC Til and submitted in KPK Seed Council for registration for commercial cultivation in KPK province
- Distinctness, Uniformity and stability data of mustard advance line MS-57 (NARC-Raya) was recorded by the scientists of Federal Seed Certification and Research Department in December 6th and February 2nd, respectively
- Distinctness, Uniformity and stability data of groundnut advance line PG-1254 (NARC-Nawaz) was recorded by the scientists of Federal Seed Certification and Research Department
- Groundnut variety NARC-Nawaz (PG-1254) developed by NARC scientists submitted in PARC Variety Evaluation Committee for recommendations
- Distinctness, Uniformity and stability data of soybean advance line SA-7260 (NARC-Golden-Soy) was recorded by the scientists of Federal Seed Certification and Research Department in 21-11-2023
- Soybean variety NARC-Golden-Soy developed by NARC scientists submitted in KPK Seed Council for registration for the commercial cultivation in KPK province
- Maintenance and Purification of inbred lines: During 2023-24, in total 61 and 173 inbred lines (A, B & R) of sunflower and rapeseed, respectively and 600 accession/lines of soybean were planted for screening, purification, maintenance and seed increase
- Development of new hybrid combinations: Twenty two (22) and twenty eight (28) new hybrid combinations were, respectively made in sunflower and rapeseed during 2023- 24
- During 2023-24, Oilseeds Program contributed a total of 17 advance lines / hybrids for national testing in NUYT trials that included 5 Sunflower, 04 rapeseed-mustard, 03 Soybean, 02 Sesame and 03 Groundnut
- Oilseeds Program produced 267 tons of soybean (produce 150tons&117tons quality seed) and NARC Sarson (6.83 ton), Groundnut (0.05 ton), linseed (0.085 ton) and sunflower (0.48 ton) quality seed provided to farmers
- Program facilitated 20 BS students for their Internship training included two students of M.Phil.

Institute of Plant and Environmental Protection (IPEP)

Executive Summary

Pests, the noxious organisms in agriculture, are controlled by using huge quantity of synthetic pesticides. However, only a small portion (0.1%) of these toxic chemicals reach the target organism, the rest disperse in the environment causing pollution, health and trade issues. The IPEP executes a two-prong approach i.e. monitoring & evaluation of the problems associated with pesticides and search for safer biological plant protection strategies.
The ERP, an ISO-17025 accredited lab of this Institute, is mandated to monitor pesticide residues for food safety and exports facilitation. The commodities like grains, fruits, vegetables and other miscellaneous food & environmental samples have successfully been analyzed through in-house developed and validated methods. The studies on monitoring of Pesticide Residues in tomato and potato revealed that 58.8% of total samples were found to be contaminated with different pesticides in which ~7.8% were non-compliant with EU-MRLs. The most frequently detected pesticides were imidacloprid and tebuconazole, while the pesticides exceeding the EU-MRLs were chlorpyrifos, metalaxyl, pyraclostrobin, tebuconazole and thiamethoxam. Based on these studies, a low level human health risk was calculated, however low levels don not remain low forever.

Similarly, under CABI sponsored project residues of about seven pesticides were detected in chili samples among which profenofos was the most frequently detected and problematic compound. Further studies are underway to minimize the use of profenofos by incorporating neem based botanical pesticide in pest-controlled strategies on chili crop.

Identification and characterization of insect-pest is of paramount importance before devising any pest control measure. For this purpose, the National Insect Museum (NIM) houses and curates about hundred thousand insect specimens including 18766 Pusa collection. As for as live insect are concerned, work on Insect toxicology, Insect Systematics, Insect Ecology, and Insect rearing are carried out to develop integrated pest management strategies for economically important insect pests of field and horticultural crops in IPMP. Research work are being carried out on biopesticides (botanical, microbial, RNAi), area-wide integrated pest management (AW-IPM) incorporating the male annihilation technique (MAT), bait application technique (BAT) and the sterile insect technique (SIT) against *Bactrocera* fruit flies and improvement of grain storage for reducing the losses caused by stored grain insect pests. Furthermore, screening of germplasm in National Uniform Yield Trial (NUYT) for variety evaluation is a regular activity of this Program.

Moreover, as the vertebrate pests also causes huge losses to agriculture produce hence trials on rodents and wild boar were carried out under field and lab condition for the formulation of new and improved baits & baits delivery systems for the management of these vertebrate pest. Achievements of different Programs of IPEP in relations to their respective activities and allocated budget are given below:

Ecotoxicology Research Program

Activity	Achievements
Pesticide Residues Analysis	
Replacement of profenofos with biopesticide to mitigate profeonofos residues CABI funded (Rs: 2.2 million)	• To mitigate the residual concentration of profenofos on chilies the second application of profenofos was replaced with biopesticides. • Profenofos concentration in the biopesticide treatment was less than the farmer's standard practice treatment. • Both acute and chronic dietary health risks were slightly lower in biopesticide treatment than the farmer's standard practices treatment.
Analysis of Pesticide Residues in Tomato CABI funded (Rs.2.0 million)	• A total of seventy-six tomato samples were analyzed for eighty one pesticides on LC-MS/MS from selected tomato producing districts of Azad Jammu and Kashmir, Balochistan, Gilgit-Baltistan, and Punjab. • 17% of the total samples were contaminated with nine different pesticides. • Highest percentages (28.5%) of contaminated samples were from Balochistan province followed by Azad Jammu and Kashmir (18%). • One sample from district Khushab was found to exceed the European Union Maximum Residue Limits (EU-MRLs), while one sample from Azad Jummu & Kashmir was found non-compliant with Codex Alimentarius Maximum Residue Limits (CAC-MRL). • Most frequently detected pesticide was tebuconazole that was detected in four samples.
Potato PARC Research Fund 1.6 Million	• Sixty three pesticide residues were monitored in twenty six potato samples collected from Rawalpindi / Islamabad. • The validated method has LOD values lower than EU MRLs for all the detected pesticides. • Seven pesticides were detected from a single potato sample collected from Mangal Bazar, I-9, Islamabad. • The detected concentrations of all pesticides were lower than MRLs set by FAO/WHO Codex Alimentarius Commission. However, imazalil, propiconazole and tebuconazole detected concentrations exceeded their corresponding EU MRL levels.

National Insect Museum Program

Activity	Achievements
Collection and Curation	• The National Insect Museum (NIM) collects, maintains, and curates a reference insect collection. NIM holds about 100,000 specimens, including 18,766 from the prestigious Pusa collection, a pre-Partition British legacy, enhancing the museum's extensive holdings.
Field Research and Discoveries	• Five exploratory surveys were conducted across various ecologies of Pakistan, including Azad Jammu and Kashmir, for insect collection. • Over 2,838 insect samples were collected from the field, with 38 species identified and added/replaced in the housed collection
Scientific Advancements	• Phylogenetic trees for 35 out of 51 Odonata species have been prepared using DNA identification techniques
Research Support and Collaboration	• Forty insect specimens were identified for various institutes, universities, and research organizations. • Five PhD, twelve MPhil, and ten BSc (Hons) students were supported in their research on insect biodiversity
Publications and Outreach	• Six research articles have been published in HEC-recognized journals. • Over 800 visitors were briefed on insect fauna at NIM.

Insect Pest Management Program

Activity	Achievements
Screening of Germplasm for releasing only resistant varieties against insect pests PSDP funded project on productivity enhancement of wheat and rice (Rs. 0.9 million)	• 80 germplasm/entries of wheat against aphids were screened under field and laboratory settings against aphids. • 264 germplasm/entries of rice (Fine, Coarse, and Hybrids) were screened against rice brown plant hopper and rice leaf folder under field and laboratory settings. • 600 entries of soybean against insect pests were screened under field conditions. • 23 entries of sunflower were screened against insect pests (whitefly, assids, aphids) under field conditions. • 04 advance lines of chilies were evaluated for their performance against whitefly, aphids under greenhouse settings. • 397 maize entries were screened against insect pests.
Development of Bio pesticides PSDP funded project on productivity enhancement of wheat and rice, Rs. 1.6 million	• A nanomaterial coated molecular bio pesticide was developed, which yielded 8-10% higher mortality in wheat aphid under field settings. • 01 indigenously developed microbial bio pesticide was evaluated and it caused 69% mortality in wheat aphids. • A molecular bio pesticide loaded on nanomaterial showed 11% higher efficiency against rice brown plant hopper.
Development of Biological Control PSDP funded project on productivity enhancement of wheat and rice and sugarcaneRs. 0.5 million	• Conservation biological control of aphid resulted in 14% higher yield of wheat. • A semiochemical treatment enhanced parasitism efficiency of *Trichogramma* against rice leaf folder. • *Telenomus remus,*an indigenous parasitoid showed successful control of fall army worm.
Nutrients Management for Pest control	• Slow release of urea fertilizer by coating it with oil reduced wheat aphids infestation and increased 4% yield.

PSDP funded project on productivity enhancement of wheat and rice,Rs. 0.1 million	
Fruit flies management MoU project, Rs. 1.4 million	• A new lure was discovered that can be utilized in fruit flies management. • Essential oil isolated from the indigenous plant showed promising results as a substitute of imported lure, methyl eugenol. • Machine learning techniques for differentiating the fruit flies species complex were developed.

Vertebrate Pest Management Program

Activities	Achievements
Improvement in the palatability of existing baits for the effective and sustainable control of wild boar. ALP Funded (8.2m)	Overall six experiments were conducted at Muzafferabad, AJK, Attock and NARC Campus. **Evaluation of maize base bait and additives against wild boar under captivity**: Dough ball was more preferred over simple maize grains. Addition of wheat flour made the texture of dough balls more palatable. In case of additives preference test molasses and shaker was mostly preferred as a bait enhancer followed by animal fat, peanut butter/oil. **Masking the Taste and Smell of Acute Poison Under Laboratory Condition:**Out of 3 formulations of acute poison tested dough ball bait incorporated with animal Fat gave 52.50% consumption rate. **Evaluation of wax coated gelatin capsules in dough ball bait:**Out of 252 dough balls offered on all bait station only 92 were consumed indicating 36.5% consumption rate. Need to improve this baiting strategy to withhold the inserted capsules inside the dough balls. **Evaluation of an acute poison sodium monfluoroacetate (1080) in culled poultry heads:**Overall 92 heads were consumed out of 174 on all baiting points indicating 53% consumption rate. Whereas, on day one 87% consumption rate was recorded from all bait station and on second day only 11% consumption was recorded. **Research Trial on Development of Zinc phosphide 4% Dough Ball Bait against Wild Boar:**Total poison ball placed on all bait stations on first nigh was 285 and 275 were consumed indicating 96.49%. **Evaluation of Racumin (Coumatetralyl) grain bait for wild boar management at NARC campus:**A total of 1623.5 kg of bait was placed at all baiting points, out of which 1032.7 kg of bait was consumed which shows 63.61% consumption rate.
Development of cereal bait formulation for sustainable management of field rats (Core Budget)	Experiment was performed at 3 different stages of wheat crop i.e. initial, heading and maturity. It is recommended that Millet + Wheat + Peanut butter + Racumin (slow poison) are an effective combination for controlling field rats before sowing of wheat crop.

National Sugar and Tropical Horticulture Research Institute (NSTHRI) Thatta

During 2022-23 following R & D activities on sugarcane variety development and other crops were implemented at PARC-NSTHRI, Thatta under Non-development and development projects. The results of each activity are summarized as under:

Sugarcane Variety Development Activities

The institute with its core mandate is striving to develop new sugarcane varieties having high cane and sugar yield qualities, commercially acceptable to the growers and sugar mills. The sole motive behind sugarcane varieties development is to contribute for enhancing cane yield of the growers and sugar recovery of the Sugar Mills. The detail of sugarcane variety development activities and quality seed production of newly developed sugarcane varieties is as under:

Evaluation and Selection of Sugarcane Clones/Genotypes cropping year 2023:

Different variety evaluation trials i.e. 1st cycle, 2nd cycle, 3rd cycle, 4th cycle, preliminary yield trial, advanced varietal trial, NUVYT (first and second plant crop) were conducted during the cropping year 2022-23. In each variety evaluation trial, selection and rejection of clones/genotypes was made on the basis of certain desirable characters. The selected clones/genotypes were promoted to next selection stage for further evaluation in the next season 2023-24. The progress of all sugarcane variety evaluation trials is as under:

- **Single Plant Trial:** total 7500 seedlings were maintained. Out of the total single plants, 3150 were selected and shifted to 1st cycle.
- **First Cycle:** a total of 695 clones were maintained. Out of the total clones, 172 were promoted and planted in 2nd cycle.
- **Second Cycle:** a total of 71 clones were maintained in 2nd cycle. Out of the total clones, 37 were promoted and planted in 3rd cycle.
- **Third Cycle:** a total of 35 genotypes were evaluated as 3rd cycle. Out of the total genotypes, 10 genotypes i.e. Th-2302, Th-2308, Th-2311, Th-2313, Th-2319, Th-2320, Th-2322, Th-2323, Th-2325 and Th-2331 were promoted and planted in 4th cycle.
- **Fourth Cycle:** Total 07 sugarcane genotypes i.e. Th-2201, Th-2202, Th-2213, Th-2209, Th-2210, Th-2211, Th-2212, along with Th-2109 as check variety were evaluated in 4th cycle. Out of total, six varieties viz. Th-2201, Th-2202, Th-2210, Th-2211, Th-2212 and Th-2213 were selected and promoted to preliminary yield trial for further evaluation.
- **Preliminary Yield Trial:** total 6 promising sugarcane genotypes, i.e. Th-2107, Th-2108, Th-2112, Th-2120, Th-2124 and Th-2126 along with check variety Th-2109 were maintained at NSTHRI, research site. Out of total, four genotypes were evaluated and promoted in advance trials i.e. Th-2107, Th-2112, Th-2120 and Th-2126 were selected and planted for further testing and evaluation in advanced varietal trial
- **Advanced Varietal Trial:** performance of 05 promising sugarcane genotypes i.e. Th-2009, Th-2026, Th-2041, Th-2042 and Th-2043 developed from local fuzz along with Yt-55-Thatta as check was tested in advanced varietal trial at NSTHRI research site (Makli farm) Thatta.
- **Sugarcane Genotype Selected for NUVYT Study:** The promising sugarcane line Thatta-1909 and Th-318 on account of better performance in terms of cane yield, sugar recovery and other characters of commercial worth has been selected for further study in NUVYT (2023-2025 cropping seasons) , the seed of the promising sugarcane lines of the institute viz Th-1909 and Th-318 has been sent for further multiplication and evaluation in NUVYTs (2023-25 cropping season) at following different sugarcane research institute of country.
    - Sugarcane Research Institute, Faisalabad, Punjab
    - Fatima Sugar Mills (Pvt) Ltd, Kot Adu Punjab
    - Sharkar Ganj Sugarcane Research Institute Jhang, Punjab
    - Sugar Crop Research Institute, Mardan, KPK
    - Sugar cane Research Station, Khanpure, Punjab
    - Sugarcane Research Section, ARI, Tando Jam, Sindh
    - NIA, TandojamSindh
    - Safina Sugar Mills (Pvt) Ltd Chenoit, Punjab
    - A.R.I. Dera Ismail Khan, KPK

- **Seed Increase Trial:** During 2022-23, total 23 different sugarcane genotypes/varieties namely Thatta-10, Thatta-2109, Thatta-326, YTTh-55, YTTh-53, YTTh-236, SLTh-1510, Th-1504, YTTh-1707,YTTh-1705, Th-1421, HoTh-127,Th-1412, Th-1210, Th-1312, HoTh-300, Th-1631, Th-1629, Th-1201, Th-910, HoTh-409, HoTh-311 and HoTh-318 were planted and maintained as seed increase trial and seed was utilized for development of sugarcane bud chip nursery and provided to different growers.

National Uniform Varietal Yield Trial:

National Uniform Varietal Yield Trials (NUVYT) are conducted at national level under the coordination program of sugar crops. The detail is given as under:

- **NUVYT First Plant Crop-2022-2024:** Total 11 sugarcane varieties were maintained in NUVYT trial at NSTHRI research site (Makli farm) Thatta. Sugarcane lines Th-1822, Th-1970, CoTj-1111 and S-2016-SL-306 produced maximum mean cane yield of 124, 103.06, 102.22 and 101.85 t ha^{-1}, respectively against the check varieties Yt-55-Thatta and Th-2109 which produced mean cane yield of 120.00 and 105.92 t ha^{-1}, respectively.
- **NUVYT Second Plant Crop2021-2023:** Total 9 sugarcane varieties were maintained in NUVYT trial at NSTHRI research site (Makli farm) Thatta. Maximum mean cane yield of 115.38 and 108.89 was obtained from line ytth-1705 and S-2016-SL-284 respectively against the check varieties Yt-55-Thatta and Th-2109 which recorded mean cane yield of 104.00 and 95.33 t ha^{-1}, respectively.

Sugarcane Juice Quality Analysis:

Sugarcane genotypes in different research trials were analyzed for different quality parameters i.e. brix%, pol%, purity% and commercial cane sugar percentage (CCS %). The findings are as under.

- In third cycle new sugarcane genotypes the sugarcane genotypeTh-2322 had CCS of 13.10% against the check variety Thatta-10 which had CCS of 13.76%. The rest of the genotypes in the trials had next better per performance in terms of CCS which was more than 11.80%.
- In fourth cycle Maximum CCS of 13.18% was recorded from Th-2212 against the check variety Th-2109 which produced CCS of 12.98%.
- Preliminary: Th-2126 and check variety Th-2109 were best with maximum CCS of 13.39 and 13.31%, respectively.
- In advanced varietal trial the sugarcane genotypes Th-2026 and Th-2041 performed well with CCS of 13.50 and 13.45%, respectively; against the check variety YT-55-Thatta which produced CCS of 13.43%.
- In NUVYT First plant crop: Sugarcane varieties S-2015-CPFG-639, NIA-2013, and S-2015-CPFG-660 remained on top with CCS of 13.85, 13.71, and 13.35%, respectively; against the check varieties Th-2109 and YT-55-Thatta, which produced CCS of 13.34 and 12.94%, respectively
- In NUVYT second plant crop sugarcane: Maximum CCS of 13.87, 13.82, and 13.71% was recorded from CPFG-402, CPFG-307, and SLSG-1652 sugarcane varieties respectively, against the check varieties Th-2109 and YT-55-Thatta which produced CCS of 13.27, and 12.89%, respectively.

Monitoring and Screening of Sugarcane Varieties against Insect Pests:

The insect pest infestation data was recorded from all sugarcane varietal development trials i.e. 3rd cycle, 4th cycle, preliminary yield trial, advanced varietal trial and NUVYT. The progress is as under.

- **Third cycle:** Mean borer infestation was in range of 8.13-11.4% in evaluated sugarcane genotypes. The genotype S-98SP-133/33 and Th-1307/64 remained highly susceptible and Th-1301XTh1008/67 was susceptible to borer complex infestation. While, all remaining genotypes had less than 8.00% infestation. Overall results, 1 genotype was found highly susceptible, 3 susceptible, 3 moderately susceptible, 8 less susceptible, and 20 resistant.
- **Fourth cycle:** The maximum mean infestation 8.19% was found in Th-2202 followed by Th-2210, Th-2209, Th-2202, Th-2212, Th-2211, Th-2109, Th-2201 and Th-2213 with mean infestation 7.88%, 7.78%, 7.69%, 7.65%, 7.29%, and 6.78% respectively.
- **Preliminary yield trial:** The maximum infestation of 8.33% was found in Th-2107 followed by (7.29%) in Th-2108, (7.27%) in Th-2112, (6.56%) in Th-2124, (6.43%) in Th-2126, and (6.11%) in Th-2109.
- **Advanced varietal trial:** The maximum mean infestation of 7.47% was found in Th-2026 followed by Th-2041, Th-2042, Th-2043, YT-55-Thatta, and Th-2009 with a mean infestation of 7.34%, 7.22%, 7.10%, 6.78 and 6.35% respectively.

- **NUVYT (1st plant crop):** Mean borer complex infestation was found in range of 8.64% - 5.56%. The maximum infestation 8.64% was found in NIA-2013
- **NUVYT (2nd plant crop):** Mean borer complex infestation was found in range of 8.19%-5.46%, however the maximum infestation was obtained in SLSG-1652 and minimum infestation was found in YT-55-Thatta.

Horticultural activities:

The horticultural activities are maintained and take all agronomic requirements like insecticides, fertigation, irrigations, inter-culturing, weeding, pruning, and plinking, etc. were undertaken regularly.

- Maintained the existing plants in the horticulture mother blocks: 21 Chiku, 13 Guava, 11 Falsa, 02 Pomegranate, 08 Fig, 01 Peach, 17 Ber/Jujube, 40 Grapes, 06 Lemon, 01 Jack fruit, 07 Guava-Sindhi Bhao, 5 Guava-Ramzan Riyali, and 24 Kronda.
- Prepared Neem 700, Acacia, Acacia 2000, Conocorpus 3000, , and Falsa 30 nursery plantation in the plastic shopper bags, during the reported period as a nursery in the greenhouse, shed.
- Applied farm yard manure, Potassium, DAP, and Nitrogen fertilizer in the mother block of fruit crops to enhance nutrient levels and support healthy fruit development.
- Applied pesticide and fungicide spray to the horticultural orchard fruit plants, addressing pest and disease concerns.
- Fruit plants of Chico, Guava, Falsa, Ber, Lemon, Papaya, and Sweet lime have received yields of 40.88, 27.25, 5.45, 109, 1.36, 27.25, and 21.80 mounds/acre respectively.
- Different fruit and ornamental plants have been propagated. The mature nurseries were transferred into polyethylene bags, ensuring better growth conditions and ease of handling. Initiated the propagation of citrus, Guava, Falsa fruits, Tamarind, Mango, Sweet lime, Grape Fruit, Lemon, Fig, Tropical Almond, and Grapes ornamental and flowering
- Two varieties of Peach fruits (8 plants) i.e., Early Grand, and Florida King, Orange, Grapefruit, and Mitho have been planted, in the prepared basins mixture of soil and farmyard manure.

Other Activities

To evaluate adoptability performance of new rice entries under Thatta climatic conditions 2023: A total of 08 rice genotypes of NIGAB, PARC along with GSR-268 & check IR-6 were transplanted under agro-climatic conditions of Thatta. The maximum yield 54.91 maunds per acre were obtained from GSR-268, followed by GSR-48 (52.65maunds-1), GSR-252 (51.44 maunds-1), GSR-305 (46.82maunds-1), IR-6 (45.4maunds-1), KFK-133 (42.18maunds-1), GSR-366 (41.82maunds-1), GSR-176 (38.36.4maunds-1), PK-1121 (27.57maunds-1), and Super basmati (26.55maunds-1), respectively

To evaluate the performance of different rice entries of PARC-NIGAB under Thatta climatic conditions 2023:

A total of 11 lines were received from PARC Islamabad.The maximum yield 76.95 maunds per acre were obtained from entry No. 12, followed by entry No. 08 (43.91 maunds-1), entry No. 08 (43.91 maunds-1), entry No. 08 (43.91 maunds-1), entry No. 08 (43.91 maunds-1), entry No. 02 (39.43 maunds-1), entry No. 09 (38.67 maunds-1), entry No. 10 (37.98 maunds-1), entry No. 06 (33.96 maunds-1), entry No. 11 (29.97 maunds-1), entry No. 03 (23.64 maunds-1), entry No. 07 (22.45 maunds-1), entry No. 01 (21.40 maunds-1), entry No. 04 (14.4 maunds-1), and entry No. 05 (9.59 maunds-1) respectively. The yields of remaining entries were remaining less than 40.00 maunds per acre./

Activities under Productivity Enhancement of Sugarcane Project (PSDP-PESC, PARC Component, Thatta):

Maintenance of National and International Sugarcane Germplasm for flowering study:
Germplasm 2022-23 crop: In sugarcane germplasm a total of total of 311 varieties/lines of germplasm were planted for flowering study and fuzz collection during 2022-2023 at Makli experimental farm, Thatta. The trial was non-replicated with 5-meter-long single row at 1 meter apart. Out of total, 95 were booted, 91 had complete flowered and 5291.5-gram true fuzz was collected from the same sugarcane lines.

Maintenance of Sugarcane Crossing Block for Quality Fuzz Production:
Crossing block trial 2022-23 crop: Total fourteen matched flowering behavior crosses of sugarcane lines were maintained at Makli farm for the purpose of quality fuzz production under field conditions. Collected 145 g sugarcane fuzz from the same varieties.

Collection, Drying and Storage of Sugarcane Fuzz:
Total 17.5 kg fuzz was collected from Makli experimental farm Thatta and different areas of extreme coastal climate in Thatta, Badin and Sujawal districts. The fuzz was dried properly, packed in polythene bags and stored in deep freezer (-20 ^{0}C).

Sowing of Sugarcane Fuzz, Raising and Maintenance of Nursery:
A total of 7500 seedlings were developed from locally collected fuzz. These seedlings were maintained at PARC-NSTHRI, Thatta.

Sugarcane Bud Chip Technology:

- Sugarcane bud chip method is an innovative planting method for enhancing sugarcane yield and quality. Bud chip method ensures pure seed development of sugarcane varieties and assists to avoids the admixture of other varieties seed. With the sole objective to provide quality seed to the end users a close coordination and mutual linkage was developed with the growers and individuals of sugar mills. Technical guidance for enhancing sugarcane crop productivity was also provided. The progress is as under.
- **Seedling development through sugarcane bud chip technology:** A total of 79,730 seedlings of five sugarcane varieties namely Yt-55-Thatta (31045), Th-2109 (23265), HoTh-300 (15790) Th-1504 (3430) and Th1909 (6200) seedlings were developed/produced by bud chip methods at PARC-NSTHRI, Office
- **Seed multiplication through bud chip:** Sugarcane seed was multiplied through bud chip on 11 acres at different locations of Sindh.
- **Seed multiplication through conventional planting method:** Sugarcane seed was increased on 50 acres in different location of Sindh.
- The seed of Thatta 300 planted in 100 acre at Sayed Khourshed Shah Farm Saleh Pat,Sukur
- **Maintenance of sugarcane lines of NIGAB, Islamabad:** Total 10 sugarcane lines of PARC-NIGAB, Islamabad were maintained at NSTHRI office premises. All of the varieties were promoted in 2nd cycle for further evaluation and selection purpose.

Activities under Patco-Winrock Pad International Project:
Under PATCO-Winrock PAD International project entitled: "Strengthening of banana Tissue culture lab of PARC-NSTHRI, Thatta" following activities were carried:

- During the reporting period, developed disease free seed of five banana varieties i.e. NIGAB-1, NIGAB-2, NIGAB-3, G-9, and Dhakka. During multiplication, developed 25745 shoots jars, 4089 jars of root-plants and 20808 plants shifted on hardening.

- Total 15250 tissue culture banana plants were sold. 13000 tissue culture banana plants were sold Rs. 40/ plant with a total earning of Rs.520,000/- and 2250 plants were sold Rs.120/plant with a total earning of 270,000/-.

Research publications:

- A.F. Soomro, S. Arain, R.N. Panhwar and A.H. Mari (2024). Evaluation of mechanized Sugarcane bud chip plantation in contrast with conventional method. Pakistan Journal of Science (Vol. 76 No. 1 March, 2024) 70-75.
- S. Arain, G.M. Kaloi, S. Ahmad, M.A Rajput, A.H. Mari, H. Wahidah, Al-Qahtani, I. A. Saleh, N. Zomot, B.H. Kiani and A. A. Abro (2024). The effect of Dichloropenoxy Acetic Acid (2,4-D) concentration on callus induction in Sugarcane (Saccharum Officinarum L.). *Submitted in International journal: Applied Ecology and Environmental Research (Accepted)*.
- A. H. Mari, G.M. Kaloi, S. Arain, R. N. Panhwar, S. Ahmad, Z. Dahri, M. K. Okla, I.A. Alaraidh, I.A. Saleh and H. Abd-Elgawad (2024). Effect of different planting method of sugar beet (*Beta vulgaris*) for growth, yield and juice quality under saline soil condition. *Submitted in International journal: Applied Ecology and Environmental Research (under review).*
- R.N. Panhwar, M. Chohan, G.M. Kaloi, A.F. Soomro, S. Arain, A.H. Mari, I.B. Bhatti and A.H. Siddiquiq (2024). Evaluation of Advanced Sugarcane (Saccharum Officinarum L.) Genotypes based on the Agro-Morphological and biochemical metrics. *Submitted in PARC journal (under review).*

Participation in Events/Programs

- 05-06-2023: One day event on "Celebration of Environment Day" was organized by ZABTech Institute, Garho Thatta. Dr. Ghulam Muhiyuddin Kaloi, Director, NSTHRI attended the event on and also participated in panel discussion on environmental issues.
- 24-07-2023: Dr. Ghulam Muhiyuddin Kaloi, Director, NSTHRI conducted viva voce of Ph.D scholar Miss Faiza Anawr D/P Anawr Ali, Department of Chemicals, Federal Urdu University of Arts, Science & Technology, Karachi on 24-07-2023.
- 03-08-2023: FAO Thatta organized one day seminar and exposure visit of growers in collaboration with PARC-NSTHRI, Thatta. The title of event was "Importance of Banana Tissue Culture and Disease Management Strategies". Dr. Ghulam Muhiyuddin Kaloi, Director, NSTHRI, Thatta delivered presentation on the subject. The Scientists of NSTHRI, FAO representatives and growers attended the event.
- 08-08-2023: A consultative workshop on "A thorough review of existing early warning system" organized by Mehran University of Engineering and Technology (MUET) Jamshoro at DC office, Thatta. Dr. Ali Hassan Mari, SSO, Mr. Mazhar Ali Mastoi, SO, and Mr. Umar Farhan, SO attended the event.
- 10-08-2023: A One day Training workshop entitled "Banana crop production and disease management" was organized by Engro Fertilizers Pakistan in collaboration with PARC-NSTHRI, Thatta. Scientist of the institute delivered presentation on the subject.
- 19-20, 08-2023: Two days seminar on "Seed Sector: Challenges and options" jointly organized by Sindh Agriculture University Tandojam and Sindh Higher Education Commission, Karachi held at Pearl Continental Hotel Karachi. Mrs. Samia Arain attended the event.
- 31-08-2023: A zoom meeting was held on Annual planning meeting of API Committee on Sugarcane was held in Islamabad. In the meeting different issues pertaining to cost of production, marketing prices and aspects of domestic crop situation came under discussion. Dr. Ghulam Mohiyuddin Kaloi, Director and Dr. Ali Hassan Mari, SSO attended the Zoom meeting.
- 14-09-2023: A one day seminar on "Managing vertebrate pests a shared responsibility" jointly organized by Vertebrate Pest Management Program PARC-NARC, Islamabad, Vertebrate Pest Control Institute, PARC-SARC, Karachi and PARC-NSTHRI Thatta. The event was held at PARC-NSTHRI, Thatta which was attended by the scientists of institute and local growers.

- 03-10-2023: A one day event "Annual Sugarcane Seminar" organized by of Faran Sugar Mills at Sheikh Bhirkio. Dr. Ghulam Muhiyuddin Kaloi, Director delivered a presentation on "Climate Change and Sustainability of Sugarcane".
- 24-10-2023: The participants of Rice Travelling Seminar led by Dr. Muhammad Yousuf, Coordinator (Rice), PARC, and Islamabad visited PARC-NSTHRI, Thatta. Director of the institute welcome the participants and briefed about rice crop situation in Sindh. Dr. Illahi Bux Bhatti, SSO, Mr. Umar Farhan, SO PARC-NSTHRI Thatta joined travelling seminar team for visit at PARC-NSTHRI, Experimental farm and Rice Research Institute, Thatta.
- 06-11-2023: The "5th International Banana Festival 2023" was held at Sindh Agriculture University, Tandojam. Dr. Ghulam Muhiyuddin Kaloi, Director, gave presentation on role of Banana Tissue culture in disease control.
- 09-12-2023: Inauguration ceremony of sugarcane traveling seminar held at DG (Research Sindh) office, Tandojam organized by National Coordinator Sugar Crops PARC Islamabad. Two scientists of the institute Dr. Ali Hassan Mari, SSO, and Mr. Mazhar Ali Mastoi, SO in sugarcane traveling seminar from 8-12-2023 to 21-12-2023.
- 10-12-2023: The delegation of Sugarcane Travelling Seminar led by Dr. Sagheer Ahmad, National Coordinator (Sugar crops), PARC, and Islamabad visited NSTHRI, Thatta. During the visit, Dr. Ghulam Muhiyuddin Kaloi, Director, NSTHRI along with other scientists of the institute briefed about R & D activities of the institute followed by filed visit of Research Trilas/NUVYTs.
- 16-05-2024: One day seminar on "**Improving sugarcane crop for sustainable agriculture under climate change scenario**" was conducted by PARC-NSTHR, Thatta under PSDP, PESC Project (PARC Sub-compnent-6 Thatta), at village Ahmad Khan Zaur, Mirpur Bathoro, district Sujawal. The seminar was attended by large number of growers, representative of Sugar Mills and the scientists PARC-NSTHRI Thatta. Director/PI and his team gave presentations. Similarly the growers shared his experience regarding PARC-NSTHRI varieties.
- 27-05-2024: One field day seminar on **"Cultivation of approved sugarcane varieties through adoption of new technology"** was conducted by PARC-NSTHR, Thatta under PSDP, PESC Project (PARC Sub-compnent-6 Thatta) in collaboration with Al-Noor Sugar Mills (Shahpur Jahania, Moro) on growers' field at village Lutfullah Bughio. The seminar was attended by large number of growers, representative of various Sugar Mills, private companies (fertilizer and pesticide), social activists and the scientists PARC-NSTHRI Thatta. PARC Scientists, representative of Sugar Mills, private companies and progressive growers shared the information and experience on sugarcane. Director/PI of the project, and his team gave presentations on approved sugarcane varieties and bud-chip technology. The Mill management of Al-Noor Sugar Mills appreciated the research work and efforts made by the scientist of PARC.

PARC-Southern-Zone Agricultural Research Center

PARC-SARC-Food Quality & Safety Research Institute (FQSRI)

Mycotoxin Lab (ML)

Assessment of toxigenic potential of A. flavus and status of total aflatoxin in spices, dry fruits, and rice sold at retail outlets of different districts of Karachi, Pakistan

The total fungal count of different marketed dried fruits and rice samples was determined by inoculation on potato dextrose agar. Aspergillus Nigar (20%), Aspergillus flavus (40%), Aspergillus practices (15%), Fusarium sp (10%) & Rhizopus sp (30%), were isolated from these samples. Total aflatoxin was estimated in peanuts (12.8 ppb), almonds (7.2 ppb) walnuts (3.5 ppb), pistachio (2.9 ppb), coconut (5.8 ppb), cashew nuts (4.5 ppb), and rice (9.8 ppb) respectively. A total of 34 strains of Aspergillus flavus were isolated from different dry fruits and rice. Among them four are atoxigenic, twenty-eight are atoxigenic to toxigenic and two are toxigenic. Branded samples of clove, cinnamon, black pepper, cumin, and cardamon were incubated for determination of fungal load on PDA and CU media. *A. flavus* (31.6%), *A niger* (10.5%), *A. paraciticus* (9.8%), *Fusarium* sp (13%) &*Rhizopus* sp (23%), were isolated from these samples. 36 Isolates of *A. flavus*

cultured from branded samples of clove, cinnamon, black pepper, cumin, and cardamon on CU media were purified on Malt Extract Sucrose agar (MESA). Primary water vials of these isolates were maintained for further experiments.

Fig. 1-3:Fungal load, band of extracted DNA

Food Quality & Nutrition Lab (FQNL)

Composite flour development for intended applications

The moisture content non-significantly varied in differently blanched and unblanched lotus root flour. Blanching increased the ash content consequently due to leached out of soluble substances whereas crude fiber content was increased in microwave blanched followed by hot water blanched LRF. There was no adverse effect of blanching on fat content. Water absorption capacity enhanced in blanched LRF most probably due to gelatinization of starch. Minimum browning index value was observed in HWB lotus root powder. Blanching as a pretreatment is effective to inhibit the activity of enzyme.

Fig. 4-6:Lotus roots, slices and powder

Pesticide & Drug Residues Lab (PDRL)

Method development and validation for Buprofezin insecticide by HPLC with UV detector.

A HPLC method was developed and validated for the determination of active ingredient of Pendimethalin herbicide in different formulation samples using different ratios of methanol, acetonitrile and water as a mobile phase with wavelengths of 270, 254 and 230 nm. Good separation was achieved by a combination of acetonitrile and water a ratio of 90:10 with a wavelength of 240 nm. The best separation was obtained at 254 nm wavelength.

Foodborne Pathogen & Microbial Contamination Lab (FPMCL)

Establishment of Rishi Mushroom Tissue Culture, Spawn and Production Technology.

Established a pure and healthy master culture of Rishi mushroom (*Ganoderma lucidum*) using the tissue culture technique, ensuring high-quality and contaminant-free fungal cultures and spawn for further propagation and cultivation.

Rishi Mushroom Tissue Culture and Spawn Technology involves isolating and sterilizing mushroom tissue samples, which is cultured on PDA to produce pure mycelium. This mycelium is used to inoculate sterilized

sorghum grain substrates, producing high-quality spawn. The spawn is then used to inoculate rishi mushroom cultivation substrates, with careful monitoring of growth conditions.

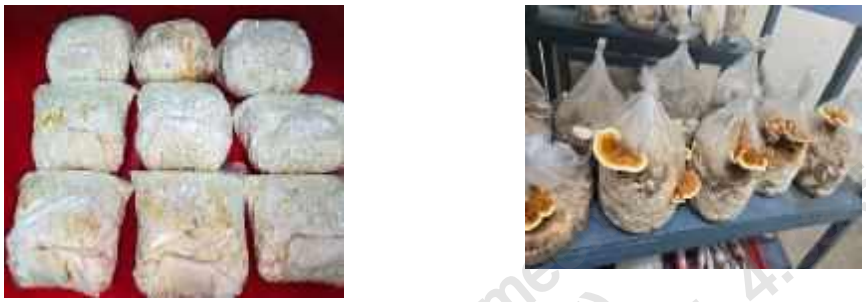


Fig. 7-8:Tissue cultured spawn and mushroom production of Rishi mushroom

Mushroom & Spawn Production Training Course

Hands-on commercial Rishi and Milky Mushroom Farming Training sessions were conducted for interested growers, NGO's and students at universities on account of capacity building.

Support in Setting Up Oyster Mushroom Laboratories in Shikarpur, Sindh.

Two low-tech oyster mushroom labs are working in Shikarpur, Sindh. The harvested yield is being utilized to produce various types of oyster mushroom pickle and jam (Murrabba).

Metallic Contaminants Lab (MCL)

Waste-water treatment with Constructed-wetland.

Five pots constructed with different layering of material viz: (from bottom to top) leaves, stones, leaves, gravel, leaves, loamy soil material/bhalu Matti. Wet land plant, common reed (*Phragmites australis*) was planted. Variation in the EC, pH, and TDS parameter was observed. Inlet sewage EC 2.92-3.02 mS, pH 7.8-8.1 and TDS 980-1290 ppm was recorded. While, after 3 to 4 days, EC, pH and TDS of outlet water ranged from 2.02-3.20 mS,7.7-8.0 and 442 to 780 ppm respectively.

Plant Tissue Culture Lab (PTCL)

Studies on initiation and multiplication of indigenous planting material of papaya (Carica papaya L.,)

A protocol for multiplication was developed by using nutrient media contained MS basal medium supplemented with different concentrations of BAP i.e. (0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 mg/L^{-1}) for multiplication and elongation of the shoot lets under in vitro conditions. The optimal concentration was 1.0 mg/L^{-1} BAP, yielding an average of 6.3 shoots per explant, markedly higher than the control (0.0 mg/L^{-1} BAP), which produced 2.1 shoots per explant.

Fig. 9-10, Papaya shoot tips before and after initiation on MS media supplemented with BAP.

PARC-SARC- Crop Diseases Research Institute Karachi

The CDRI Karachi conducts research on identification of sources of resistant to major diseases of wheat under National Wheat Diseases Screening Nursery (NWDSN), National Uniform Wheat Yield Trial (NUWYT) and screening of international nurseries, pathotype and virulence analysis of rust to monitor the changes in pathogenicity through Wheat Rust Trap Nursery (WRTN) and rust resistant gene postulation in wheat

germplasm and commercial cultivars. The wheat germplasm is critically evaluated for their resistance to the development of rusts resistant wheat varieties at national level.
The CDRI Karachi is also responsible to identify the plant pathological problems of other agricultural field crops as well. Study of seed borne pathogens of the important field crops such as wheat, rice, sorghum, sunflower, chilies, cucurbits and tomato are carried out in the laboratory. The quality of seeds is determined for boosting and increasing yield at farmer's level.
Survey, pathogenicity and control of plant parasitic nematodes associated with cereals, fruits and vegetables are carried out by using agrochemicals, organic matters and plant extracts. Eco-friendly integrated management practices against economically important diseases of vegetables and fruits are carried out.

The main achievements of CDRI Karachi are as follow:
Screening/evaluation of national wheat germplasm against wheat rusts.
Results against Stem Rust of Wheat
Out of 914 lines /entries of NWDSN, the data revealed that 495 lines (54.15%) were showed Moderately Susceptible to Susceptible (MSS), 244 lines (26.69%) were Moderately Resistant to Moderately Susceptible (M), 91 lines (9.95%) were Susceptible (S), 13 lines (1.42%) Moderately Susceptible (MS), 22 lines (2.40%) were found Moderately Resistant (MR), 2 lines (0.21%) were Trace Moderately Resistant (TMR), 01 line (0.10%) was Resistant to Moderately Resistant (RMR), 5 lines (0.54%) were complete immune Resistant (R), 01 line (0.10%) was Trace Resistant to Moderately Resistant (TRMR), 59 lines (6.45%) were showed Variable in reaction (V).
Out of 80 lines of NUWYT, 56lines (70%) were Moderately Susceptible to Susceptible (MSS), 14 lines (17.5%) were Susceptible (S), 7 lines (8.75%) were found Moderately Resistant to Moderately Susceptible (M) and 3 lines (3.75%) were variable(V) in reaction.
Results against Leaf Rust of Wheat
Out of 914 lines, the data revealed that 96 lines (10.50%) were Susceptible (S), 631lines (69.03%) were Moderately Susceptible to Susceptible (MSS), 74 lines (8.09%) were Trace Moderately Susceptible to Susceptible with low frequency (TMSS) and 80 lines (8.75%) were Resistant (R).
Results against NUWYT
Out of 80 lines of NUWYT, the data revealed that 71 lines (88.75%) were Moderately Susceptible to Susceptible (MSS), 3 lines (3.75%) were Resistant (R), 3lines (3.75%) were Susceptible (S) and 3 lines were Trace to Moderately Susceptible to Susceptible low reaction (TMSS).
Epidemiology of Wheat Rusts
The Leaf Rust Trap Nursery data revealed that Lr22b, Lr1,Lr2a,Lr2b,Lr2c, Lr3, Lr3Bg, Lr9, Lr10, Lr11,Lr12 Lr13, Lr14aa, Lr14b, Lr15,Lr16 Lr17, Lr18, Lr19, Lr20, Lr21, Lr 22a, Lr23, Lr24, Lr25, Lr26, Lr 29, Lr30, Lr32, Lr33, Lr34, Lr35 Lr36, Lr37, LrB, and Lr13 WL-711 showed Virulence. The Lr3Ka Lr10 and Lr27+Lr31 were showed resistant a-virulent while Lr28 and Lr19 variable in reaction.

- Under inoculated condition the data of Stem Rust Trap Nursery revealed that Sr5, Sr6, Sr7a, Sr7b, Sr8b, Sr9a, Sr9b, Sr9g, Sr10, Sr11, Sr12, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr27, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38, SrWld-1,SrTmp, Sr21 and Sr27 were virulent reaction
- The Sr8a, Sr9d Sr9e, Sr13, Sr19, Sr22, Sr23, Sr25, Sr26, Sr32, Sr33, Sr35, Sr37, Sr39, Sr40 and Sr2 complex were intermediate to moderate a-virulent.
- The Sr24 & Sr31 showed resistant a-virulent against Stem rust.

Surveillance and integrated Management approaches of Root knot and root rot diseases associated with Brinjal and Okra
The data of survey revealed thatamong 20 different fields of brinjal, 70% prevalence root knot nematode was observed with 80% of disease incidence, whereas, there were 18 fields of okra were surveyed and results showed 27.77% disease prevalence and 55.55% disease incidence for root knot nematodes.
On the basis of root colonization percentage, results indicated that *Fusarium oxysporum* is the dominant soil borne mycoflora in brinjal fields, followed by *Macrophomina phaseolina* and *Rhizoctonia solani* while in okra fields *Macrophomina phaseolina* is the dominant fungus followed by *Fusarium oxysporum* and *Rhizoctonia solani.*

Screening of sugarcane cultivars against whip smut (*Sporisoriumscitamineum* syn. *Ustilago scitaminea*
During 2023 out of 12 genotypes tested, 8 were showed different levels of disease incidence percentage and characterized in different groups according to their reaction types. The genotype S-2015-CPFG-660 was observed Highly Resistant (HR) with disease incidence 2.94% and two genotypes namely Th-2202 and Th-2211 were showed Resistant (R) with 6.25and 6.27% disease incidence. While, the genotype NIA-2013, S-2015-CPF-639 and Th-2209 were found as Moderately Resistant (MR) with 10.48, 11.95 and 12.13% disease incidence respectively. On the other hand, the genotype Th-2213 was observed as Moderately Susceptible (MS) with 17.89% disease incidence. Whereas, maximum disease incidence (20.09%) was recorded in Th-2212and characterized as susceptible (S). However, the rests four genotypes in the trial were found immune to whip smut disease when artificially inoculated before planting.

National Sugar and Tropical Horticulture Research Institute (NSTHRI) Thatta
During 2022-23, following R & D activities on sugarcane variety development and other crops were conducted at PARC-NSTHRI, Thatta. The results of each activity are summarized as under:

SUGARCANE
Evaluation and Selection of Sugarcane Clones/Genotypes cropping year 2023:
A total of 7500, 695, 71, 35 and 7 sugarcane lines were tested in 1st, 2nd, 3rd and 4th cycle. The respective genotype number of promoted genotypes to next stage was 3150, 172, 37, 10 and 6.

Preliminary Yield Trial: A total 6 promising sugarcane genotypes, i.e. Th-2107, Th-2108, Th-2112, Th-2120, Th-2124 and Th-2126 along with check variety Th-2109 tested. Out of total, 4 genotypes i.e. Th-2107, Th-2112, Th-2120 and Th-2126 were selected for next stage.

Advanced Varietal Trial: a total 5 sugarcane varieties i.e. Th-2009, Th-2026, Th-2041, Th-2042 and Th-2043 developed from local fuzz along with Yt-55-Thatta as check was re-tested for confirmation previous results.

NUVYT Study: Two promising sugarcane lines Thatta-1909 and Th-318 of NSTHRI Thatta were selected for NUVYT planted on 9 sugarcane research institute of country.
(v) Sugarcane Juice Quality Analysis: Sugarcane genotypes in different research trials were analyzed for different quality parameters i.e. brix%, pol%, purity% and commercial cane sugar percentage (CCS %). The CCS in research trials were ranged between 11.5 to 13.76 %.

Monitoring and Screening of Sugarcane Varieties against Insect Pests: The insect pest infestation data was recorded from 3rd cycle, 4th cycle, preliminary yield trial, advanced varietal trial and NUVYT. Mean borer infestation was in range of 6.5 to -11.5%

HORTICULTURAL ACTIVITIES:
Maintained horticulture mother blocks of different fruit crops and nursery of different fruit and ornamental plans. The some of the fruit plants were on fruiting. A yield of 40.88, 27.25, 5.45, 109, 1.36, 27.25, and 21.80 mounds/acre was obtained from Chiku, Guava, Falsa, Ber, Lemon, Papaya, and Sweet lime, respectively.

RICE CROP ACTIVITIES
Adoptability performance of new rice entries under Thatta climatic conditions 2023: A total of 8 rice genotypes of NIGAB-PARC were tested. The maximum yield of 54.91 maunds per acre were obtained from GSR-268, followed by GSR-48 (52.65maunds-1), whereas, minimum yield of 27.57maunds per acre from PK-1121.

ACTIVITIES UNDER PRODUCTIVITY ENHANCEMENT OF SUGARCANE PROJECT:
Sugarcane germplasm study: a total of 311 varieties/lines of germplasm were planted for flowering study and fuzz collection. Out of total, 95 were booted, 91 had complete flowered and 5291.5 gram true fuzz was collected.

Crossing block: Total 14 matched flowering behavior crosses were planted at Makli farm and obtained 145 g sugarcane fuzz.

Collection, Drying and Storage of Sugarcane Fuzz: Total 17.5 kg fuzz was collected from Makli experimental farm Thatta and different areas of extreme coastal climate in Thatta, Badin and Sujawal districts. The fuzz was dried properly, packed in polythene bags and stored in deep freezer (-20 ^{0}C).

Sowing and Maintenance of Fuzz Nursery: A total of 7500 seedlings were developed from locally collected fuzz. These seedlings were maintained at PARC-NSTHRI, Thatta.

Sugarcane Seedling development through bud chip technology: A total of 79,730 seedlings of five sugarcane varieties namely Yt-55-Thatta (31045), Th-2109 (23265), HoTh-300 (15790) Th-1504 (3430) and Th1909 (6200) seedlings were developed/produced by bud chip methods. The seedlings were distributed to different growers.

Seed multiplication of NSTHRI Developed Sugarcane varieties: Sugarcane seed was multiplied on 11 acres through bud chip and 50 acres through conventional method on different locations.

Maintenance of sugarcane lines of NIGAB, Islamabad: Total 10 sugarcane lines of PARC-NIGAB, Islamabad were tested under agro-climatic conditions of Thatta. The performance of all of varieties was satisfactory and were promoted in 2nd cycle for further evaluation.

ACTIVITIES UNDER PATCO-WINROCK PAD INTERNATIONAL PROJECT:
Under PATCO-Winrock PAD International project entitled: "Strengthening of banana Tissue culture lab of PARC-NSTHRI, Thatta" following activities were carried:
During the reporting period, developed disease free seed of five banana varieties i.e. NIGAB-1, NIGAB-2, NIGAB-3, G-9, and Dhakka. A total 15250 tissue culture banana plants were sold. Out of total 13000 tissue culture banana plants were sold Rs. 40/ plant with a total earning of Rs.520,000/- and 2250 plants were sold Rs.120/plant with a total earning of 270,000/-.

PARC-SARC-Institute of Plant Introduction

Executive Summary

The mandate of IPI is to introduce and evaluate different plants for their adaptability in the region, in this regard, following plants were introduced for evaluation at IPI, Karachi.
The institute of plant introduction works on agronomic trials and maintained the existing germplasm of Coconut, Tamarind, Ber, Chiku, jojoba and Moringa. Healthy and matured nuts of Srilankan tall green coconut variety have been targeted for further multiplication. This institute Provide technical services to Malir and Gadap farmers on grafting of ber and Chiku plantation and support kitchen gardening to promote urban agriculture.

Introduction and History of IPI

The plant introduction center was first established in 1975 in accordance with a project on enhancing Pakistan's agricultural research capabilities. The Agri-Res Council prepared the project entitled "National Plant Introduction Center" in Islamabad, which was a five-year coastal project that included a provision for the establishment of five sub-stations in provinces. The infrastructure including buildings and farm acquired from Sindh government in 1975. It was renamed and declared as Coastal Agricultural Research Station in 1998. Due to agroclimatic conditions the station has been upgraded as Institute of plant introduction in 2013.

Objectives

- Introduction and propagation of indigenous plants and their cultivation in coastal region
- Introduction of exotic varieties of crops, fruits, vegetables and ornamental plants for evaluating their potential and suitability under local conditions
- Development of agronomic packages for indigenous and exotic varieties

- To undertake training and technology transfer for the benefit of end users

Research Activities

Introduction of Quinoa at IPI

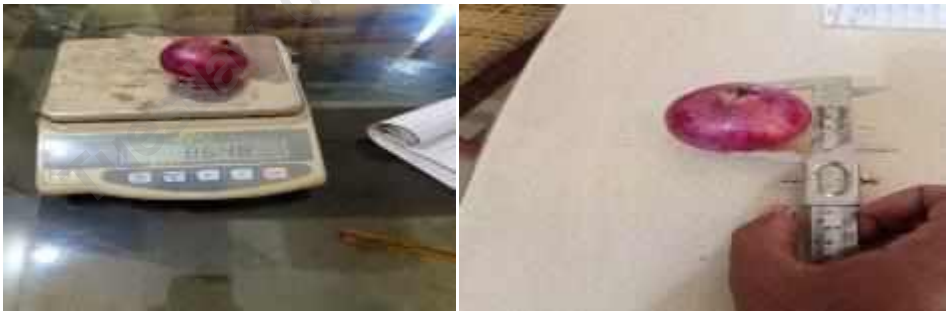
- Using marginal quality irrigation water on Quinoa (Chenopodium quinoa) water productivity under mulch in Indus delta. The experiment was conducted at IPI under marginal quality irrigation water having TDS 1800 ppm by using two irrigation treatments with mulch and without mulch. There were five numbers of irrigation applied on each treatment. The total amount of water applied were 500 m^3 per hectare under each treatment.
- The average plant height, terminal Panicle length and terminal Panicle weight was observed under T1 as 148.6cm, 32.6cm and 34.6gm per plot respectively. However, the average number of branches and number of spikes per plot under t1 were 25.4 and 12.4 respectively. And average weight of grain per plant under T1 was found 140 and 55 gm respectively. However, the average number of plants and weight of grain per plant was found 55 gm.
- Table 1 shows that the total yield obtained under T1 and T2 was found 1100 and 966 kg. ha-1 respectively. Whereas the total water used under both irrigation treatments were 500m3. ha-1. The water productivity under T1 was found higher as 2.20 kg.m-3 whereas, without mulch (T2) it was observed as 1.93 kg.m-3. Likewise, the harvest index under T1 and T2 were observed as 29.64 and 28.66% respectively.

Table 1. Yield, Water used and WP under T1 and T2

S. No	Treatment	Total Yield (kg/plot	Total Yield (kg. ha ^{1})	Total water used (m^3. ha^{-1})	WP ($kg.m^3$)
1	T1	3.3	1100	500	2.20
2	T2	2.9	966	500	1.93

Introduction of Onion at IPI

- Introduction of Onion (Nasarpur) variety was planted on one acre at IPI under furrow mode. Overall germination percentage of onion was recorded 86 percent under furrow mode.
- Overall, nine (09) irrigation applied using furrow mode. 50 kg of DAP, 100 Kg of NP and 50 Kg of Urea were applied during land preparation.
  Dual gold weedicide 3 ml/ L (Pre-emergence) spray in onion field. 1 bag of DAP applied/ acre.
- The average diameter of onion bulb was recorded as 6.3 cm with the average weight of onion was observed as 95.23 gm at IPI.



Introduction of Olive tree at IPI

- Introduction of new Olive varieties (Arbosana, Arboquina) from Spain. Olive varieties (Arbosana, Arboquina) Spain variety including Hagi bananca, Picual Perlilino local Janboui and local Manzanilla was introduced and propagated in nursery. Olive plants were delivered to the progressive farmers of olive potential area in khirthar range Dadu Nawabshah and Gadap Karachi under National Olive project.

Olive (Arbosana Arboquina) under nursery

SriLankan Coconut

SIGNIFICANT ACHIEVEMENT

Introduction of dragon fruit at IPI

Dragon (*Selenicereus undatus*) is a tropical plant also called pitaya, are becoming more and more well-liked in Pakistan because of their unusual look and excess of health advantages. The fruit grows well in many regions of Pakistan, yet it is native to South America.

A tropical fruit belonging to the cactus family is the dragon fruit. Its outside is a vivid pinkish-red color with green scales, and its inside is either pink or white with tiny black seeds. Because of its low-calorie content and mild sweetness, this fruit is a favorite among consumers who are health conscious.

In Pakistan, June to August is the ideal time of year to plant dragon fruit. This gives the plants time to establish themselves before the arrival of the cooler months. With the correct care and attention, however, dragon fruit can be cultivated all year round. Dragon (Selenicereus undatus) was planted at the Institute of Plant Introduction of PARC in Karachi for introduction and propagation.

First, DUA Foundation, a Karachi-based NGO, sent 28 dragon fruits (Red H-un datus) of South American origin. Using drip with marginal quality irrigation having EC of 3.2dSm^{-1}, the cuttings were planted in the field at IPI in 2021. After almost one year the plants were matured and flowering was started. Few flowerings were sheds due to high temperature. Three trees bearing dragon fruit were picked for their initial crop. The fruit weighed an average of 370 grams. Overall, Dragon Fruit has performed satisfactorily.

Collaboration of IPI with other departments

IPI has close collaboration with Department of Plant Protection, Federal Seed Certification Department, DUA foundation, Islamic Relief Pakistan, IUCN, Mehran University of Engineering and Technology and Pakistan Navy.

Collaboration with local growers
Growers of the locality visit IPI farm regularly and IPI has distributed enough plants (Karonda, Moringa, Neem, Sweet Tamarind etc) raised in IPI nursery to create close collaboration with farmers and to propagate the germplasm.

PARC-SARC-Pest Management Research Institute

Introduction

Pest Management Research Institute started its journey as "Chemistry Section" during 1954 in the Department of Plant Protection (DPP) and it became "Federal Pesticide Research Laboratory (FPRL)" in 1973 and this laboratory was transferred to Agricultural Research Council (ARC) in 1979 with the mandate to analyze and test formulated pesticide samples for registration to ensure and streamline the import of pesticide as per registered composition and specification, and to provide quality control at the time of import, etc. During 1992, again mandate of this laboratory was transferred to Department of Plant Protection. After this, this laboratory was renamed as Pesticide Research Institute working under umbrella of PARC-Tropical Agricultural Research Centre (Now SARC) with a mandate to undertake research on quality control, residues of pesticides in food, agricultural crops, soil, water, human blood and insect toxicology etc. However, in August 2013 this institute was re-designated as Pest Management Research Institute (PMRI) and is carrying out research on various aspect of insect pest management, insecticide toxicology, insecticide resistance against insects and ecological studies on insects of agricultural importance etc.

Objectives

- Development of protocols for Integrated Pest Management in crops, fruits and vegetables.
- Evaluation of insecticides for their comparative efficacy against insect pests on fruits and vegetables.
- Monitoring of resistance to pesticides in insect pests.
- Toxicological investigation to determine effects of pesticides on crop production system and the environment.
- To undertake training of the stakeholders on safe use of pesticides by applying appropriate IPM models.

Research Activities

Assessment of damage potential of pulse beetle (Callosobruchus maculatus (Fab.) (Coleoptera: Bruchidae) on different pulses under Laboratory Conditions The C.maculatus caused maximum weight loss percentage (3.7 %) in cowpeas, followed by green gram (1.8%) and chickpea (1 %) respectively. The least damage (0.2%) was recorded in black gram. However, (0%) loss was recorded in kidney bean in one and half month storage period.

Monitoring of different species of fruit flies by using attractant methyl eugenol at PARC-SARC, Experimental Field Monitoring of fruit flies using methyl eugenol was carried out throughout the in Ber orchard at SARC-Experimental field. During observation three different species of fruit were recorded i.e *Bactrocera zonata, Bactrocera dorsalis,* and *Bactrocera correcta.* The species *Bactrocera zonata* was found dominant among all species and its population remained above 90% throughout the year. However, population of Bacrocera dorsalis remained above 5% during cold months of year and population of *Bactrocera correcta* remained below (2%) throughout the year. A new species was also recorded whose identification is under process.

Study the comparative efficacy of different insecticides and Neem oil against onion thrips Onion crop is mostly attacked by thrips and downy mildew. Both of these pests cause considerable damage to crop. Due to attack of thrips leaves get shrivel and chlorophyl of plant synthesis is badly affected. Keeping in view the importance of onion thrips a trial was conducted to test the efficacy of different insecticides including neem oil at SARC-Experimental field. Results of study revealed that Karate (Lamdacyhalothrin) significantly reduced the population of thrips after 24 hours of spray followed by Chloropyriphos. However, neem oil and Abamectin did not significantly reduce the population of thrips.

Study the field parasitism percentage of Acerophagus papayae in papaya mealybug in Papaya Orchards at Malir, Karachi Surveys were conducted in papaya orchards in district Malir Karachi to determine field parasitism percentage of *Acerophagus papayae*, a potential parasitoid of papaya mealybug in cold and hot months during 2023-24. The field culture of papaya mealybug was brought in PMRI laboratory and mummified mealy bugs were observed. It was observed that papaya mealybug was present on papaya plants throughout the year. During February, March peak parasitism percentage was recorded and it was up to 21%, however, during colder months parasitism percentage decreased and it was recorded up to 8% during December -January.

PARC-SARC-Vertebrate Pest Control Institute
Achievements:
Detection and Augmentation of ECTO and ENDO-parasites of Rodent Pest

- During reporting period, we investigated the prevalence of ecto and endoparasites of rat species. The highest r ecto parasite prevalence rate was observed in *Rattusrattus* species was *Polyplaxspinulosa* i.e., 45.2%, followed by *Xenopsyllacheops* 20.3%, *Echinolaelaps* 10.5%, *Xenopsyllaastia* 10%, and *Haemolaelaps* 9.2%.
- The lowest eco-parasites prevalence percentage was recorded for *Ambyloma* species which was 4.8%. In *Rattusrattus* the highest infection percentage observed for *Hymenolepisswatensis* sp.n was 26.2%, Heterakis sp was 25.5%, Aspiculuris sp was 24.1%, *Lutziellamicroacetabularae* was 23.8%, Syphacia sp was 23.4%, *Hymenolepisfusa* 22.1%, *Lutziellaswatensis* sp was 21.1%, and *Hymenolepisdiminuta* had a lowest infection percentage that was 18.6%.
- The incidence percentage of ecto and endoparasites of rats species. The highest incidence percentage observed for Hymenolepis diminuta that was 29%, followed by Syphacia sp was 21%, Aspiculuris sp was 13%, Heterakis sp was 12%, Lutziella swatensis sp was 7.5%, Hymenolepis swatensis sp.n recorded a incidence percentage of 7%, Lutziella microacetabularae was 5.4%. and Hymenolepis fusa had a lowest incidence percentage that was 4.1%.

Isolation, Characterization and Pest Management Of Secondary Metabolites (Strychnine From *Strychnos Nux-Vomica*)

- The objective of this study was to introduce innovative techniques for managing rodent populations. This involves the use of poisonous plant *Nux vomica tree (Strychnos nux-vomica)* also known as Kuchla.
- The toxicity of extracted Strychnine phytochemical from *Strychnos nux vomica* were examined against *Albino rats*, pest of multiple commodities by using invivo and invitro tests to inspect overall efficiency against its growth stages.
- Characterization of strychnine from *Nux* was evaluated through phytochemical analysis where orange ring was indicated. Anti-feedent index % of adult Albino in response to formulated bio-rodenticides bait after 24hr at 1000ppm were; 1.41, at 2000ppm were; 2.62 and at 3000ppm were; 2.91.
- After 48hr at 1000ppm were; 2.12, at 2000ppm were; 2.52 and at 3000ppm were; 3.12. Toxicity of strychnine against adult Albinos through IV technique the regression evaluated as; *R*2= 0.8406

Vertebrate Pest (Rats) Control Through Isolated Secondary Metabolites From Mango Peel (*Mangifera INDICA*), Curry Leaves (*Murraya KOENIGII*) And Moringa Leaves (*Moringa OLEIFERA*)

- The purpose of this research was to introduce the new green techniques of rodent control. Flavonoid detected through phytochemical analysis and thin layered chromatography where reddish-brown ring in test tubes was indicated the successful extraction flavonoid.
- In TLC result, yellow band with Rf value i.e., 0.46 indicated the flavonoid separation. Anti-Feedent Index% Of Adult Albino in response to Formulated Biorodenticides Bait after 24hr at 1000ppm were; [Moringa: 3.74, Curry: 3.22 and Mango: 7.69], at 2000ppm were; [Moringa: 4.52, Curry: 5.87 and Mango: 8.23] and at 3000ppm were; [Moringa: 7.77, Curry: 15.7 and Mango: 11.2]. After 48hr at 1000ppm were; [Moringa: 3.98, Curry: 2.33 and Mango: 7.69], at 2000ppm were; [Moringa: 5.52, Curry: 1.24 and Mango: 8.23] and at 3000ppm were [Moringa: 4.71, Curry: 2.61 and Mango: 11.2].
- Toxicity of Flavonoid against adult Albinos through IV technique the regression evaluated as; Mango peel: *R*2= 0.9886, Curry leaves: *R*2= 0.7981 and Moringa leaves: *R*2= 0.975.

Histopathological Effects of Rodenticides on Some Functional Organs Of Laboratory Rat

- The aim of this study was to study the effectsof poisons on the organs of rats at a tissue level after applying different poisons on their bodies.
- After **Strychnine** application, Kidney Show ++ = moderately severe, diffuse lesions of Glomerularandtubular degenerationand necrosis, Thrombosisand vasculitis. After moringa application Kidney show ± = Mild, focal lesions; Glomerular and tubular degeneration and necrosis, show + = Moderate, multifocal lesions of Thrombosis and vasculitis. After mango peel application Kidney Show + = Moderate, multifocal lesions of Glomerular and tubular degeneration and necrosis, Thrombosis and vasculitis.
- After Strychinine application Liver Show ++ = moderately severe, diffuse lesions Vacuolar degeneration and necrosis Thrombosis and vasculitis. After Strychinine application Heart Show ++ = moderately severe, diffuse lesions and necrosis show + = Moderate, multifocal lesions of Thrombosis and vasculitis.
- After **Brodifaucum** application Kidney Show ++ = Moderately severe, diffuse lesions Glomerular and tubular degeneration and necrosis, Show + = Moderate, multifocal lesions of Thrombosis and vasculitis. After Brodifaucum application Liver Show + = Moderate, multifocal lesions of Vacuolar degeneration and necrosis, Thrombosis and vasculitis.

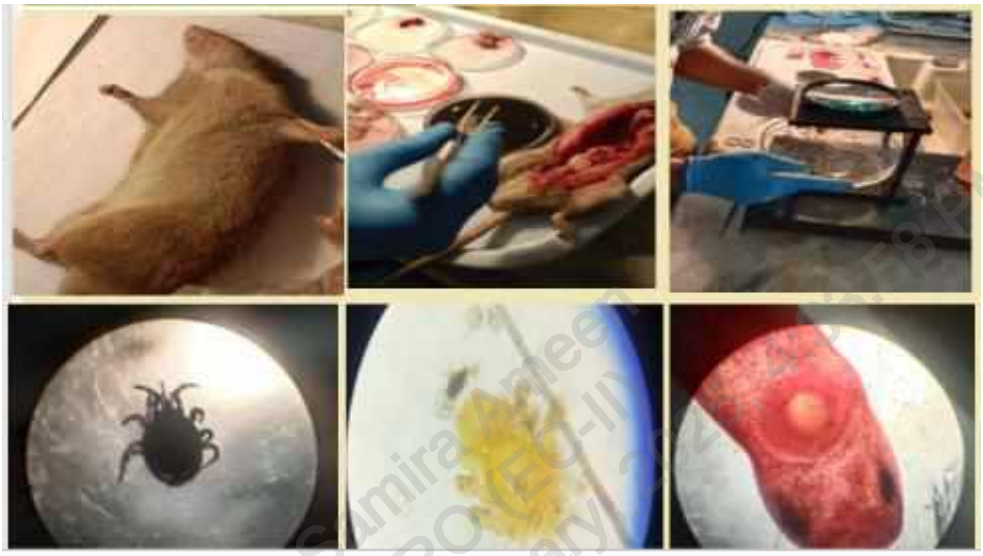
Breeding and Behavioral Studies of Albino Rats and Field Rat (*Rattus Rattus*)

- Albino and field Rats were collected from field areas ofPARC-SARC and HEJ Institute, University of Karachi. Both species of rats were accumulated with in a same environmental conditions.
- The albino's gestation period was prolonged up-to 21-25 days and gave birth to 4-6 babies in a single litter. Animals from both housing conditions were divided in two groups: Light (tested between 8am to 5 pm) and Dark (reside between 7 pm to 7 a.m.; *n* = 10/per group).
- Behavioral tasks performed during the light phase were conducted under a white-light illumination (200 Lux), while behavioral procedures performed during the dark phase were conducted under without light.
- These conditions were used in order to avoid the following interfering factors: (i) masking effects (such an increasing in activity when the lights are switched off or a decreasing in activity when the lights are switched on); and (ii) phase shifting along the days (due the lights being kept on during dark phase or the lights being kept off during light phase).

OCCURRENCE AND MORPHO-TAXONOMY OF HELMINTH PARASITES OF EDIBLE FISHES FROM COAST OF LASBELA. (M.PHIL STUDY)

- Collection of fishes, detection/identification and record of infectious agents (parasites) of zoonotic importance.
- Out of 153 fishes belonging to 13 different species were examined for helminth parasites.
- The percentage of infected fishes was 14.37%.
- Infected organs were preserved in 2% formalin for histo-pathological studies.

PICTURES OF DIFFERNT ACTIVITIES



Introduction and Augmentation of Identified Ectoparasites on Rats as a Bio-control Strategy

Soxhlet extraction of Phytochemicals from medicinal Plants

Phytochemical testing of Phytochemicals


Albino after testing of Phytochemicals

PARC-SARC, Outreach Research Activity Unit (ORAU)

Capacity building of farming community.

The meetings were conducted with the Directors/In-charges of SARC-PARC Institutes i.e. Director FQSRI, Incharge VPCI & Incharge PMRI regarding capacity building of farming community to support the research activities of SARC-PARC & discussed for disseminating the modern technologies.

The study conducted to evaluate performance of *Moringa Oleiferria* under mulching & non-mulching method.

The plantation of *Moringa Oleiferria* was carried out. The neem straw was used as mulch in the basin of plants. The agronomic data of average Plant height, No of branches, Stem girth, No of pods of mulched plants were collected and was recorded as 271.5 inches, 100 numbers, 7.03 inches and 70 respectively. While the average Plant Height, No of Branches, Stem girth, No of pods of non-mulched plants were also collected as 215 inches, 92 numbers, 5.50 inches, 55 respectively.

The evaluation performance of Responsive Irrigation system (RDI) on Orchard plants in coastal climate at PARC-SARC, Karachi.

The orchard i.e. olive, chicku, jujube, fig, falsa, lemon etc have been planted under RDI system at SARC-Experimental field. The all plants observed to have given good response under RDI system. The Ber/Jujube plants born fruits with good quantity & quality under this system.

Plantation of Ornamental Plants in the premises of ORAU office.

As per directives of DG-SARC, the different plants i.e. Karonda plants & Conocorpus for hedge purpose & flower bulb were planted for the beautification of ORAU.

Collaboration of ORAU with other departments

ORAU has close collaboration with, Federal Seed Certification & Registration Department, Department of Plant Protection & Agriculture Extension Department (Government of Sindh) to serve the farmers in resolving their issues related to agriculture sector.

Kitchen gardening activity.

After availability of water the kitchen gardening activity is going on. The different seasonal vegetables i.e. Okra, onion, reddish, turnip, bitter gourd, tomatoes, chilies, cauli flower etc were also grown on small scale at this office.

Project proposals submitted at DG-SARC, Karachi.

Research Proposals (2022-23) of PARC-ORAU (SARC), were submitted on

- Development of Advanced irrigation techniques through solar water pumping system & Drip/Bubbler Irrigation system for enhancement of water productivity & energy at IPI Farm/Farmers Field at Karachi.
- Capacity building of farming community for skill development in Agriculture sector in Sindh

Research Proposal (2023-24) of PARC-ORAU (SARC), were submitted on

- "Modernization of soil fertility through integrated plant nutrient management system for marginal soils in Karachi region of Sindh".
- Evaluation of exotic plants using solar desalinization ALP 9th batch collaborate with Dr. Kamran Bakash Soomro.

Picture-1: Sugarcane Seedlings developed through bud chip technology at PARC-NSTHRI

Pictur-3: Tissue Culture, Horticultural activities at Laboratory on Banana Crop

PGRI Annual Report (2023-2024)

Plant Genetic Resources Program

The National Genebank of Pakistan, located at PGRI, NARC, Islamabad, is the sole national facility for conserving plant genetic resources. It is mandated to support breeders engaged in crop improvement. Plant

Genetic Resources (PGR) management and conservation are the Institute's core functions. The final germplasm inventory in the genebank reached to 43200 accessions, which are accessible to researchers within the National Agricultural Research System (NARS) for their research endeavours.

Germplasm Distribution: This year, the National Genebank of Pakistan received 161 seed requests from various institutions and universities. After verifying that the requests complied with required SOPs, 9,477 accession samples of diverse crops were provided to breeders, researchers, and universities nationwide.

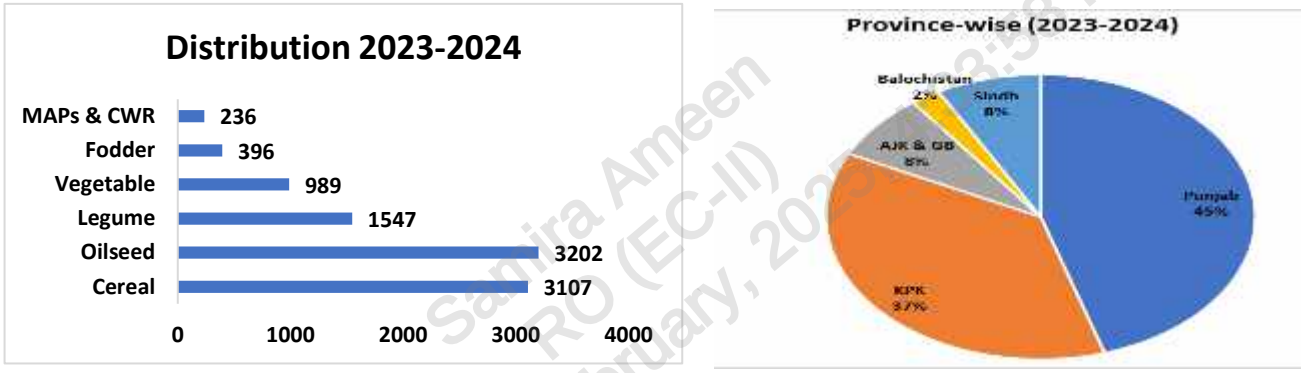


Figure. 1: Distribution of germplasm accessions to stakeholders by crop groups and provinces.

The major crop groups requested were cereals, followed by oilseeds and legumes, indicating a research focus on major crops.

Acquisition/Donation and Collection:
Approximately 4,549 samples of various crops, including wheat, vegetables, and medicinal and aromatic plants (MAPs), were added to the Genebank collection this year. These additions resulted from acquisitions, collections, and generous donations from multiple sources. This expansion enhances the diversity of the Genebank's holdings, solidifying its role as a crucial resource for future agricultural research and crop improvement.

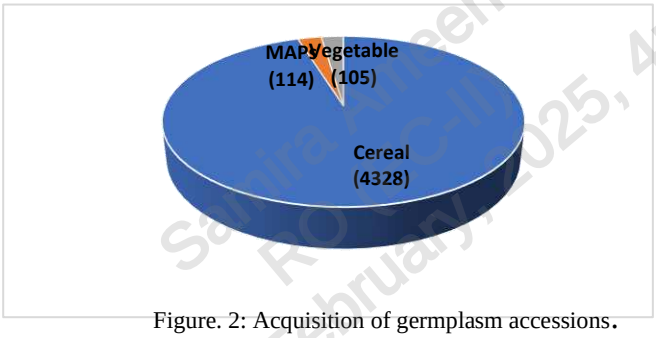


Figure. 2: Acquisition of germplasm accessions.

Seed Germination and Viability Testing: The viability of conserved germplasm accessions is routinely assessed at regular intervals to maintain up-to-date information on their status. This ongoing monitoring is essential for ensuring the longevity and quality of the stored genetic material. Over the past year, 5,276 accessions were tested for viability, demonstrating the Genebank's commitment to safeguarding these valuable resources.

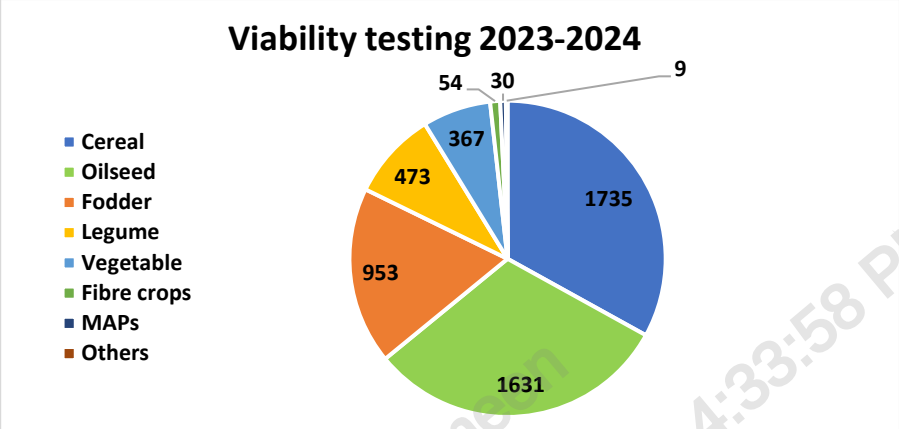


Figure. 3: Viability testing of various crop groups

Evaluation and Characterization of Germplasm: Germplasm accessions of various crops, including linseed, brassica, rice, wheat, maize, soybean, lentils, quinoa, mung bean, cowpea, mash bean, brinjal, chili, garlic, turmeric, onion, and tomato, preserved in the National Genebank of Pakistan, were regenerated and characterized for morphological traits.

Biochemical & Molecular Evaluation of PGRs: Total seed storage proteins from rice, wheat, maize, lentils, safflower, groundnut, and cowpea germplasm were evaluated for genetic diversity using SDS-PAGE.

***In-vitro* propagation of Germplasm:** *In vitro* conservation of sugarcane, potato, sweet potato, and orchid was conducted during the reporting period using various concentrations of growth hormones in MS culture media.

Evaluation of germplasm for resistance against different diseases: Germplasm was screened for resistance to various diseases, resulting in the identification of eight mung bean (charcoal rot resistant), twenty-six mash bean (charcoal rot resistant), eleven soybean (charcoal rot resistant), forty-six chickpea (ascochyta blight resistant), seven groundnut (three accessions highly resistant to Tikka disease, four resistant to Rosette disease), five alfalfa (alfalfa mosaic virus resistant), and twenty wheat lines (yellow rust resistant). Ten seedborne fungi (Aspergillus niger, Aspergillus flavus, Penicillium, Fusarium, Curvularia lunata, Bipolaris, Trichoderma, Alternaria alternata, Rhizopus, and Colletotrichum) were identified based on morphological characteristics.

Medicinal Aromatic Plants and Herbs Program

Management and adaptibility of herbs:

Multiplication of MAPS (Withania coagulans, rosemary, lemongrass, thyme, stevia, sweet basil, oregano, lavender mint, pennyroyal mint, and lavender) was carried out through stem cuttings, and plants were subsequently transferred to the field at PGRI. Musk bala (Valeriana wallichi), moosli, anjbar, asparagus, and mint collected from Murree and Nathiagali were acclimatized in a glasshouse. Albizia, oregano, moringa, papaya, rocket, and fenugreek were propagated from seeds.

A clonal repository was maintained in both the glasshouse and field at PGRI. Total phenolic content was determined for 49 fenugreek accessions to assess antioxidant properties. Total phenolic and flavonoid content, as well as antioxidant potential through DPPH assays, was determined for 43 Ajwain accessions to evaluate antioxidant properties.

National Herbarium Program

Native medicinal, aromatic, edible, and ornamental plants, as well as herbarium specimens, were collected from Swat (Deesan hills, Osh Nala, Sho Nala, and Mahudand track), southern Sindh, Kurram, Chitral, Astore, Minimarg, Chilas, Upper Swat, and Kohistan districts. A total of 331 herbarium specimens of native flora from various regions were accessioned into the national collection. Over 500 native and exotic plants collected from diverse ecologies are being cultivated in the Botanical Conservatory.

Three new Astragalus species—Astragalus pseudoanisacanthus from Zhob district, Astragalus roseocephalus from Margalla Hills National Park, and Astragalus quettensis from Hazarganji National Park, Quetta—were described, along with Nepeta margallaica from Margalla Hills National Park.
Atriplex micrantha, collected from Chitral, represents a new record for Pakistan, while Smirnowia turkestana from Chaghi is a new generic record for the country. Plant identification services continued to be provided to visitors, scientists, and masters and doctoral students from various institutions to support their research endeavors.

Human Resource Development at PGRI

Three Ph.D. students and thirty-eight research interns from various universities and academic institutions are being trained in agro-morphological characterization and evaluation of crop germplasm under field conditions. Laboratory work includes biochemical and molecular analysis, in-vitro conservation, seed viability testing, seed processing, gene-bank management of plant genetic resources, and herbarium specimen identification.

Awareness and Information Dissemination:

A total of 740 visitors, including high-level national and international delegates, dignitaries, researchers, and university students, toured the National Genebank and allied facilities. Visitors received briefings on plant genetic resources (PGR), genebank management, and other PGRI activities. Two seminars/workshops were held to raise awareness about the importance and utilization of plant genetic resources in crop improvement programs. Fourteen research articles were published in national and international peer-reviewed journals.

NATURAL RESOURCES

Climate, Energy and Water Research Institute, NARC

Rooftop rainwater harvesting potential for kitchen gardening in the Rawal watershed

This study in Pakistan's Rawal watershed found that rainwater harvesting from rooftops could be a viable solution for kitchen gardening. Even a single-room house can collect enough rainwater to grow vegetables on a 25m^2 plot (1 Marla). Storing this monsoon rainwater can be used throughout the year, potentially increasing food production on land areas up to 1339 m^2 (53 Marla) for a five-room house. This method and replenishing groundwater reserves by 1.2 meters annually could significantly improve food security and water access in urban and rural areas.

Water Conservation and Garlic Production: A Field Comparison of Furrow, Drip, and Responsive Drip Irrigation Systems in Pakistan

Field experiment was conducted to assess the performance of a recently introduced responsive drip irrigation (RDI) system for garlic (Allium sativum L.) cultivation under silty loam conditions in Islamabad, Pakistan. The RDI system was compared with the conventional furrow irrigation (FI) and drip irrigation (DI) systems. The results revealed that the RDI and DI systems significantly reduced irrigation water usage (by 94% and 48%, respectively) compared to the FI system (443 mm). Moreover, both RDI and DI resulted in slightly higher average dry garlic yield (3% and 11%, respectively) compared to FI (13.491 tons/ha). This can be attributed to the improved water application efficiency of RDI and DI, which minimizes water losses and ensures that plants receive the water they need for optimal growth. Consequently, the RDI and DI systems exhibited significantly enhanced water productivity (by 94% and 46%, respectively) compared to FI (1.536 kg/m3). In conclusion, the study demonstrated that the RDI system is a promising irrigation strategy for garlic production in water-scarce regions. It offers the potential to conserve water resources while maintaining or even improving crop yields, thereby contributing to enhance food security.

Estimation of Rooftop Rainwater Harvesting Potential and Water Budgeting analysis at NARC

A study at Pakistan's National Agricultural Research Centre (NARC) analyzed 30 years of weather data to assess the potential of rainwater harvesting for orchards. The analysis indicated that capturing rainwater could provide a significant contribution to irrigation needs. Specifically, rainwater harvesting has the potential to supply 191.56 ha cm of water annually, which fulfills nearly half (52%) of the total orchard water demand of 367.12 ha cm. However, it's important to note that there would still be a seasonal water deficit of 175.55 ha cm, representing 48% of the annual demand. This deficit would need to be addressed through supplementary irrigation from sources like groundwater pumping or canals.

Study on the Efficiency of Different Irrigation Systems for Garlic Cultivation

A field experiment compared drip irrigation methods for garlic. Responsive Drip Irrigation (RDI) used 11.2% less water and yielded 8.1% more garlic compared to standard Drip Irrigation. Nano Drip Irrigation saved 14.9% water but produced only 3.7% more garlic than standard Drip Irrigation.

Updation of Agro-ecological zones of Pakistan

A significant spatiotemporal disconnect was identified between existing agro-ecological zoning of Pakistan (established in the 1980s) and current climatic, land use, and irrigation realities. To address this, a PSDP project (2020-2023) has re-delineated the country's agro-ecological zones. The new zoning highlights dominant ecologies like the Western dry mountains (19.1%), Western dry plateau (14.4%), and Sandy desert (14%). This updated framework informs targeted interventions for water management and agricultural practices. Specifically, promoting water conservation techniques and climate-smart agriculture in dry and rainfed regions is crucial. This knowledge will be instrumental in future endeavors to promote sustainable agriculture, water resource management, and land use policies, ultimately improving the productivity of various economic sectors in Pakistan.

Predicting soil loss in the Upper Indus Basin, Pakistan

A study in Pakistan's Hindu Kush, Karakoram, and Himalaya (HKH) region assessed soil erosion risk for sustainable agriculture. While over 62% of the area faced very low risk, nearly 14% had moderate risk. The remaining areas showed a concerning trend, with 6.8% and 7.4% of land experiencing high and very high erosion risk, respectively. These results highlight the need for forest and pasture conservation in higher elevations to prevent soil loss and downstream environmental damage.

<u>Honeybee Research Institute, NARC</u>

Established TIKA-PARC Beehive Products Research Laboratory

Worthy chairman PARC along with His Excellency Ambassador of Turkiye to Pakistan Prof. Dr. Mehmet Paçacı, Vice president of TİKA. Dr. Umit Naci YORULMA, Country head TİKA Pakistan Muhsin BALCİ, **Inaugurated the** Bee Products Laboratory at the Honeybee Research Institute (HBRI), National Agricultural Research Centre (NARC), and Islamabad, made possible through the generous support and collaboration of TIKA. Chairman PARC extended heartfelt gratitude to TIKA for their invaluable contribution and unwavering commitment to strengthening our agricultural research capabilities. This state-of-the-art laboratory marks a significant milestone in our ongoing efforts to advance apiculture research and development in Pakistan. Already TIKA has established an artificial queen insemination Laboratory at HBRI which of great importance for quality queen production.

Religioning of Labellum and Glossae Biomorphological characteristics of honeybee workers as a breeding tool on honey collection potential of *Apis mellifera* L. honeybee colonies

This study focused on the correlation of honey collection Potentialand the length and width of labellum and glossae in western honey bees *Apis mellifera* Ligustica. It is concluded that Biomorphological characters of labellum and glossae are significantly correlated with the honey collection Potential in *A. mellifera* L.

Aptness of bee venom collection on hygienic and hoarding behavior of Honeybee *Apis mellifera* L.

The research not only opens promising paths for optimizing collection methods and exploring therapeutic applications but also underscores the need to balance technological advancements with pollinator conservation efforts, all within the framework of ethical and sustainable beekeeping practices.

Rangeland Research Institute, NARC

Grass seeds imported from different countries of the world namely Australia, Thailand by private companies were tested for their adaptability in Pakistan. Evaluation trials of seeds were conducted in experimental field area of Rangeland Research Institute (RRI), National Agricultural Research Centre Islamabad. The objectives of study were to examine evaluation and adoptability of seeds of forage grasses imported by various seed companies. Nine varieties of grasses and forages were evaluated during 2023-24 including 02 varieties of *Lolium multiflorum,* 02 alfalfavarieties, 02 varieties of clovers and 03 other forages. Data on biomass production of the experimental grasses and forages were recorded at the end of the trials. Results showed that Rhodes grass varieties produced fresh biomass Alfa/Green star 23 t/ha, Chief 20 t/ha, Clover (SC88) 40 t/ha, Rye (88 Mel) 43.6 t/ha, Cock foot grass 14 t/ha, Rye (KNR) 44.5 t/ha, Vicia Sativa 47.3 t/ha, Persian Clover 38.4 t/ha, TF92 (Tall fesive-Noorani) 26 t/ha. Seed import has been facilitated through these adaptability trials resultantly thousands of acres of land has been grown with quality fodder ensuring quality feed for livestock. About 9 varieties of major groups of forages and grasses were evaluated for their adaptability including 02 Rye grass, 02 Clovers, 02 alfalfa, 01 Cock foot grass, Common vetch and TF92 (Tall fesive-Noorani).

Nutritional Profile of Rye Grass

Biomass produced by Rye grass line (No. 07) was recorded highest with 7.3 t/ha fresh weight, followed by line 06 with 7 t/ha as shown in the table no.1.

Biomass productivity (t/ha) and carbon stock (t/ha) of hybrid four speciesin district Pindigheb under ALP Project.

PINDI GABH SITE					
	Average Height (m)	Average Diameter (cm)	Average yield (kg)	Carbon Stock (kg)	Survival Rate
PAULOWNIA ELONGATA 9501	8.2	5.6	6.027	3.013	93%
POPULUS DELTOIDES	13.8	4.6	6.848	3.424	80%
TECTONA GRANDIS	5.3	3.9	1.867	0.933	92%
ROBINIA (TURBO OBILEX)	6.8	3.2	1.613	0.806	94%

Yield and Carbon stock of hybrid fast growing plant species at Oghi Mansehra site

OGHI MANSEHRA					
	Average Height (m)	Average Diameter (cm)	Average yield (kg)	Average Carbon Stock (kg)	Survival Rate
PAULOWNIA ELONGATA 9501	3.1	1.3	0.283	0.141	30%
TECTONA GRANDIS	4.5	1.6	0.735	0.367	75%
ROBINIA (TURBO OBILEX)	3.8	1.4	0.452	0.226	48%

Yield and Carbon stock of hybrid fast growing plant species at Muzafarabad Kashmir site

MUZAFARABAD KASHMIR SITE					
	Average Height (m)	Average Diameter	Average yield (kg)	Average Carbon Stock (kg)	Survival Rate
PAULOWNIA ELONGATA 9501	1.60	1.3	0.056	0.028	35 %
TECTONA GRANDIS	4.2	3.1	1.273	0.636	90

Balochistan Agricultural Research & Development Center, Quetta

BARDC initiated village-based seed production where 300 acres of wheat and 10 acres of barley were planted at different villages to increase availability of quality seed. Major varieties are like Akbar-19, Nawab-21, AZRC-Dera, AZRC-Daman, AZRI-96. Tijaban-10, Pisabak-21, Pirsabak-19, Zarghoon-21 along with barley varieties Rakhshan-10, JE-21 and Sanober-96.

- BARDC introduced and demonstrated 2 different Ispaghol (Plantago) cultivars in four districts Kachi, Sibi, Jhal Magsi and Kharan in Balochistan under Alp project.
- Under ALP project two improved sesame varieties (TS-3 and TH-6) were introduced in three districts of Balochistan Kachi, Sibi and Jhal Magsi to increase sesame production under marginal lands. TS-03 performed well in most of the sites with early pods formation and maturity (63, 120 days) The seed yield data showed TS-3 has maximum 727 $kgha^{-1}$ yield averaged over three locations followed by followed by TH-6 with 661 kg ha^{-1} and minimum seed yield was observed for the local landrace which produced 623 $kgha^{-1}$. The TS-3 variety is multi-tiller (branched) with early maturity and higher number of pods which resulted in higher seed yield in comparison to other varieties/land race.
- To promote pulses and increase productivity mash cultivation was carried out on 60 acres (30 acres of pre-basic seeds and 30 acres of basic seeds) in Mastung District under village based seed system. Five newly released kidney bean varieties (Tiger, Gorilla, Green Hills, Black Queen, and Swat Red) were alsi introduced in Mastung District. These kidney beans are known for their adaptability and high yield potential, making them suitable for the region's climate and soil conditions.
- BARDC produced around 400 grams of saffron and sold 5000 bulbs of saffron to different farmers.
- Olive is an evergreen tree native to the Mediterranean region. It is an economically important crop in Mediterranean countries. Spainand Italy are the main olive producers, followed by Greece, Turkey, Tunisia, Syria, and Morocco. Due to huge import Oil bills, Government of Pakistan started Olive plantation and production technologies to lessen this huge burden on Pakistan's economy. Along with reduce in import bills, other main objective of this research cum development initiative was to develop nationalandinternationallinkagesforolivesectordevelopment and developingolivevalue chain forincreasedprofitabilityandbetter.

Mountain Agriculture Research Centre, Gilgit:

- About 50,000 eyed Ova of Gansu golden trout and improved variety of rainbow trout were brought from Gansu fisheries research institute, China to TRMS on 20th March 2024. The fish is going through

temperature acclimatization and feeding trials in TRMS, once successful the fish will be propagated and introduced into farming community of Gilgit Baltistan.

- Tomato variety SAARC Nagina, Brinjal variety Nirala, Chili variety *China Red* and Radish variety *China red* gave highest yield this year. The experiments will be continued next year for.

Arid Zone Research Institute, Bahawalpur:

- PARC AZRI Bahawalpur, under the genetic improvement theme, carefully screened wheat genotypes resilient to biotic and abiotic stresses in Bahawalpur's arid climate. From these efforts, advance line AZRI-08, yielded 5675 kg/ha in the Punjab National Uniform Yield Trial 2020-21. Following this the high-yield AZRI-08 was forwarded for evaluation in the Wheat NUYT and National Wheat Disease Screening Nursery-2022-23, assessing its potential for further impact under challenging conditions
- This project aimed to reclaim salt-affected soil and saline water for agricultural purposes, specifically cotton cultivation, employing diverse techniques. Flat Bed Ridges delivered the highest cotton yield of 1802.7 kg/ha, showcasing a breakthrough for cotton productivity in Cholistan's saline soil conditions.
- Sixteen olive varieties were evaluated, with Arbequina, Gemlik, and Arbosana standing out for their impressive performance in Cholistan's drought-stressed environment. These varieties demonstrated robust growth rates and successful fruiting, marking a significant advancement for olive cultivation in the region.

Arid Zone Research Centre, D.I. Khan

- PARC, AZRC, D.I.Khan has developed Wheat variety i.e. AZRC Daman and released from Provincial Seed Council, KP during 2023.
- PARC, AZRC, D.I.Khan has developed Chickpea variety i.e.**AZRC-E8** and 2nd year DUS data has been completed. Now case will be initiated for registration from Provincial Seed Council, KP during 2024-25.
- Produced high quality seed of the following crops:

Wheat	50 tons
Chickpea	2.0 tons
Lentil	1.0 tons
Mungbean	2.0 tons
Mashbean	0.4 tons

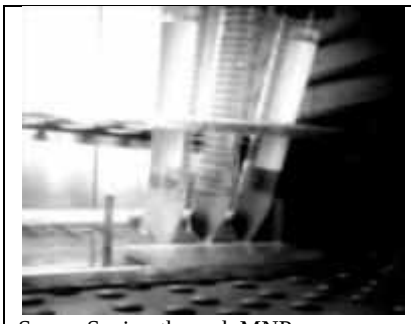
ANIMAL SCIENCES:

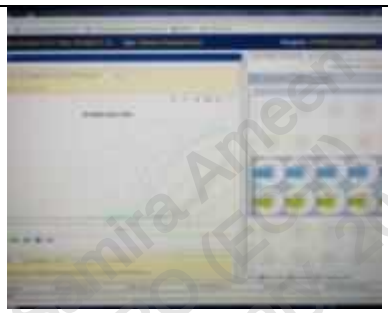
- **Breed Improvement:** To enhance the productivity and quality of livestock through breeding technologies and genetic improvement programs.
- **Nutrition and Feeding:** To develop and promote cost-effective and nutritionally balanced livestock feed and feeding practices.
- **Disease Control:** To prevent, control, and manage diseases affecting livestock and poultry, with a focus on vaccine development and epidemiological tools.
- **Aquaculture and Inland fisheries:** Improvement of productivity in fisheries through breeding, feeding and managemental practices.
- **Livestock Extension:** To provide training and education to progressive farmers/stakeholders in the livestock/poultry/fisheries sector and disseminate best practices.
- **Conservation:** To conserve and protect indigenous livestock breeds and genetic resources.
- **Environmental Sustainability:** To promote environmental friendly sustainable livestock production practices.
- **Policy Development:** To contribute in formulation process of policies related to livestock/poultry/fisheries

Detail of Research Activities, Achievements and Progress
Animal Reproduction and Genetics Program (ARGP)

Project 1: Investigations and Optimization of Sperm Sexing and Cryopreservation Techniques in Water Buffalo (ALP-337)

The paramagnetic nanoparticles (MNPs) based sperm sexing technique was optimized for buffalo spermatozoa (sexed n=20 and unsexed n=12) with sexing rate of 90% confirmed through RT-PCR and 92 % female progeny confirmed after live births.


Sperm Sexing through MNPs


Validation of sperm sexing technique by real-time PCR


Artificial insemination with sexed spermatozoa

Project 2: Nanotechnology-Enabled Improvement of Spermatozoa Cryopreservation Technique for Water Buffalos (ALP-341)

- Inclusion of Zinc Oxide, Cerium Oxide and Manganese diOxide nanoparticles at dose levels 12.29 mmol L-1, 0.43 µmol L-1 and 0.2 to 0.4 mmol L-1 respectively, in tris-citric acid cryo-diluent improved the post thaw quality of water buffalo spermatozoa.
- In-vitro toxicity effects of hydroxyapatite nanoparticles (0.01, 0.02, 0.05, 0.1, 0.20 % and control) on Buffalo Spermatozoa was determined. Results showed that the lower doses of hydroxyapatite nanoparticles (0.01, 0.02 and 0.05 % in physiological solution) were found nontoxic to buffalo spermatozoa.

Project: 3: Breed Improvement of Non-Descript Goat

- High genetics crossbred progenies of Beetal (n=15) and Boer (n=08) were produced through Laparoscopic Artificial Insemination (LAI) by using frozen thawed spermatozoa.
- Modified embryo transfer technique has been optimized for goats. Nine embryos of purebred meat type Boer breed have been transferred through modified laparoscopic technique in local non-descript goats.

Financial Resources and Budget: ALP Projects = Rs. 5.3 million

Animal Product Improvement Program (APIP)
Project 1: Effect of Nisin on the Shelf Life of Raw Meatballs

- Meatballs prepared from chicken minced meat and nisin was added at concentrations of 0g/kg (T1), 2g/kg (T2), 4g/kg (T3), 6g/kg (T4), and 8g/kg (T5).
- The total viable counts (TVC) at day 0 in T1 were $\log_{10}$ 6.54±0.73 which increased to $\log_{10}$ 8.20±0.76 on day 14 while in T2, TVC were $\log_{10}$ 5.49±0.12 on day 0 which increased to $\log_{10}$ 6.84±0.29 on day 14. This shows that nisin was very effective in controlling the bacterial growth during refrigerated storage of meatballs (as it kept the count below log 7 cfu/g).

Project 2: Development of Rapid Milk Testing Kit Exploiting Dry Chemistry for Detection of Common Adulterants in Market Milk

- Developed milk adulteration testing paper strips for neutralizers and starch detection.
- The minimum sensitivity level for these strips was found to be 0.1 %

Financial resources and budget: Available Resources and PATCO (Rs. 0.5 million)

Aquaculture and Fisheries Program (AFP)

Project1: Validation and Establishment of Intensive Production Packages for High Value Fisheries (AS-394)

- To find best polyculture system for growth performance optimization of best stocking density and species combination was determined.
- Results indicated Carps and American Channel Catfish outperformed at stocking density 1600 per acre (out of 1600, 1800, and 2200 per acre) with three species combination (two Carps and one American Channel Catfish) instead of five species combination (four Carps and one American Channel Catfish).
- Best Crude protein level i.e., 25% was optimized out of 15% and 20% in artificial feed.
- Organized a Farmer's day at Jhanghi Thuthian, District Attock, on May 9, 2024 for sharing project's achievements with farmers.
- One day national seminar was conducted at NARC on May 29, 2024 for technology transfer among scientists.

Organized a Farmer's day at Jhanghi Thuthian

National seminar for technology transfer

Project 2: <u>Introduction of a High Value Fish *Channa striatus* (Saul) in Aquaculture System of Pakistan</u>

- Achieved better growth rates of indigenous *C. striatus* about 27g/month in earthen ponds with optimum socking densities @5000/acre.
- Developed brood stock of indigenous *C. striatus* and breeding carried out successfully in earthen ponds and artificial breeding in plastic drums.
- Achieved better growth performance of exotic C. *striatus* in earthen ponds i-e 36g/month as compared to raceways 27g/month.
- Successfully cultured Moina (zooplanktons) in aquariums for feeding initial fry.

	Channa striatus acclimatization and measurement of growth performance

Financial resources and budget: Two ALP Projects = Rs. 24.152 million

National Reference Laboratory for Poultry Diseases (NRLPD)

Project1: Surveillance of Anti-Microbial Resistance (AMR) in Poultry (Flemming Fund UK)

Technical Advisory meeting (TAG):

- Technical Advisory Group (TAG) meeting held on 25th January, 2023
- 5th meeting of TAG was held in May, 2023
- TAG meeting post activity was held on 13th November, 2023.

NEQAS round 1 PT provision by NRLPD

- 14 labs were registered in NEQAS round 1
- Samples were sent to 13 labs, 10 labs responded back
- Training regarding NEQAS was conducted for all labs
- Participated in round 1 of NEQAS from 13 to 17th Nov, 2023.

Participation in PT by NRLPD

- Two rounds of EQAsia AMR-PT were received in 2023 in which laboratory results showed good performance for pathogen identification and AST analysis.
- EQAsia round 8 has been received in 2024 and after analysis, the results have been submitted during June, 2024.
-

Installation of MALDI and BD Phoenix at NRLPD

- Training session regarding use of MALDI-TOF was arranged in the first week of December 2023 by Bruker and AstoLife in coordination with FF-CG-1.
- Training session regarding BD-Phoenix was arranged in December, 2023 by AstoLife in coordination with FF-CG-1.

World Antimicrobial Awareness Week

In collaboration with Fleming Fund Country grant NRLPD arranged a seminar regarding WAAW week on 24th November 2023.

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Animal Health Program (AHP)

Project 1: One World-One Health: Holistic and Cost-effective approach to counter Brucellosis in sheep/goats in Pakistan (AS-156)

Sheep (n=35) and goats (n=35) were selected for *Brucella melitensis* Rev 1 vaccine trial at two farms in Kahror Pakka, Punjab. Blood samples were collected from experimental animals. The samples were analyzed using RBPT (Rose Bengal Plate Test). All the animals (n=70) were found negative for brucellosis using RBPT. The selected sheep and goats were vaccinated with *Brucella melitensis* Rev 1 vaccine for vaccine efficacy trial.

Vaccination of animals in the field

Project 2:Field validation of a newly developed homologous Lineage thermotolerant Peste des Petits Ruminants (PPR) vaccine for control of PPR (AS-385)

- PPR vaccine seed was revived using Vero cells. Quality control procedures for PPR vaccine seed were standardized.
- The revived seed passed the quality control testing i.e., sterility, safety, potency and identity test.

Project 3: Development of models for control of Warble fly in Pakistan (AS-340)

The warble fly prevalence was recorded higher (20–70%) as compared to last year (1-32%). In 41 districts of Pakistan. Three villages in each province, i.e., Balochistan, Punjab, and Gilgit, were selected for establishing the therapeutic control models. Each model consisted of 50 goats and 12 cattle's. All the animals in each group were administered ivermectin (1 ml/50 kg body weight) subcutaneously during August–September, while the last group was kept as a control. All the treated groups were found free of warble fly larvae while control groups showed 32-66% prevalence.

Financial resources and budget: ALP Projects = Rs. 20.48 million

Livestock Research Station (LRS)

Project 1: Nutritional Enrichment of Maize Stovers as Feed for Ruminants through Physio-chemical Treatment and Ensilation (ALP)

- A Feeding trial has been completed on cattle calves (n=16) for the comparative evaluation of various treated maize stovers/cobs on growth rate, nutrient utilization and economic efficiency.
- Four total mixed rations differing only in forage source but same concentrate to forage ratio at 1:1, on a total DM basis:
  - The TMR 1 consisted of Maize silage and concentrate,
  - The TMR 2 consisted of Urea-molasses treated maize stover and concentrate,
  - The TMR 3 consisted of Urea-molasses treated maize cobs and concentrate
  - The TMR 4 consisted of Urea-molasses treated paddy straw and concentrate.
- The results revealed that average daily weight gain was higher (0.812 kg/day) in the calves fed on TMR 1 than the other fed TMRs.
- The feed cost per unit of weight gain of calves fed TMR 3 was lowest (Rs. 375.70) than the other fed TMRs.

Project 2:Establishment of nucleus herd of Sahiwal & Cholistsani (Cattle) and Nili Ravi (Buffaloes) (PARC Research and Development Fund)

- The LRS maintained a herd comprising of 144 cattle and buffaloes which consisted of 74 Nili-Ravi buffaloes, 46 Sahiwal cattle, 15 Crossbred (Friesian x Sahiwal) cattle, 2 Crossbred (Jersey x Sahiwal) cattle and 7 Cholistani cattle.
- The recorded weights in Sahiwal male young-stock ranged from 125 kg to 211 kg; Sahiwal female young-stock ranged from 134 kg to 227 kg; Crossbred (Friesian x Sahiwal) 153 to 221 kg; Cholistani male 155 kg, Cholistani female 100 to 112 kg; Nili Ravi male 121 kg and Nili Ravi female 95 to 158 kg.
- The recorded daily growth pattern in Sahiwal male young-stock ranged from 300 g to 609 g; Sahiwal female young-stock ranged from 272 g to 687 g; Crossbred (Friesian x Sahiwal) 402 to 891 g; Cholistani male 265 g, Cholistani female 125 to 185 g; Nili Ravi male 155 g and Nili Ravi female 120 to 202 g

Financial resources and budget: ALP project = Rs. 0.800 million

Animal Nutrition Program (ANP)

Project 1: Growth performance of different backyard poultry breeds on partial free-range system (Core budget)

- Poultry birds of 3 breeds i.e. Black Australorp (BAL), Rhode Island Red (RIR) and Fayoumi (FAY) were raised on intensive feeding and partial free range with 30% less feed supplementation up to 16 weeks of age.
- Weight gain in birds on intensive feeding was significantly higher (1274g/bird) as compared to partial free-range birds (1109g/bird).
- However, feeding cost per kg weight gain during 16 weeks was 10% lower (Rs. 503) with partial free range as compared to intensive feeding system (Rs. 557).
- Among breeds, BAL birds exhibited significantly higher weight gain (1242g/bird) as compared to RIR (1177g/bird) and FAY (1158g/bird).
- These results revealed that backyard poultry can be reared economically on partial free-range system.

Rearing backyard poultry in free range

Financial resources and budget: Core budget = Rs. 0.15 million

Project 2: Mitigation of Salmonella risk by controlling rodents using different baits at poultry farm (Core budget)

- Two types of baits (NARC bait and commercial bait) were kept inside burrow (n=18) around poultry sheds and other at high activity zones of rodents at the shed and feed store (n=6) for 5 months.
- More than 40 rats were killed mainly around feed store. The feed bags remained safe from rat damage during study period.
- More than 60% reduction in mortality cases of poultry birds due to Salmonella infection was reported two months after application of baits.
- Both types of baits were equally effective in controlling rats.

Financial resources and budget: Core budget = Rs. 0.05 million

National and International linkages: National Linkage has been developed with different universities for conducting trainings on biorisk assessment.

Technology transfer:
Interns (n=32) from different universities were provided hands on trainings and livestock visitors/farmers/students (n=170) were advised regarding feed formulation and feeding of dairy and fattening animals and poultry.

Knowledge generation and management:
Three research articles published in peer-reviewed International Journals.

Visit of diplomats/dignitaries to research facility:

- Visit of JICA Experts to Animal Nutrition Lab and Feed Technology Unit
- Demonstrating the PARC Livestock feed products to different to Livestock Officials and students of various institutes from all over the country at ANP, ASI

INTERNATIONAL COORDINATION

ORGANIZATIONS	AREAS OF COOPERATION
Royal Cell Biotechnology Group	IVF lab/ Embryo production
Eastern Mediterranean Public Health Network/Global Health Development	Zoonotic Diseases (Brucellosis)
World Health Organization/National Institute of Health	One Health & Anti-microbial resistance (AMR)/ Field Epidemiology & Laboratory Training Program (FELTP)
Food and Agriculture Organization	Livestock Breed Improvement
International Center for Agricultural Research in the Dry Areas	Goat breed improvement
Fleming Fund, UK	Anti-microbial resistance in livestock/poultry and fish
National Academy of Sciences	One Health (ticks borne disease) capacity building, surveillance of Avian Influenza, Aflatoxin bio-control
Korea Program on International Agriculture	Cattle breed improvement

Technical evaluation and monitoring of research projects

S. No	Funding sources	Completed	On-going	New submission	Total
1	ALP	10	9	425	444
2	PSDP/RIAD	1*	-	2	3

3	Others MoU	1	4	4	9
4	PSF	-	1	10	11
5	Concept proposal **	-	-	6	6
Total		**12**	**14**	**447**	**473**

***** Component, ** concept proposal submitted to various countries

SOCIAL SCIENCES:

Parc Social Sciences Research Institute (SSRI), Tarnab, PESHAWAR

Allocation	**Released**	**Expenditure**	
PKR: 1500000	PKR: 1064000	PKR: 1064000	
Research Report Targeted	03	Reports Completed	03

Farmers perception and adoption of chip bud sugarcane technology in Central Khyber Pakhtunkhwa

Pakistan's per hectare sugarcane yields are significantly below potential. Enhancing productivity through innovative technologies is crucial due to limited sugarcane cultivation area expansion possibilities. Sugar Crops Research Institute, Mardan, Khyber Pakhtunkhwa has introduced and standardized chip bud technology along with associated production techniques. The agricultural extension department has been continuously disseminating sugarcane chip bud technology to sugarcane growers through various techniques. This research was conducted in two districts of Khyber Pakhtunkhwa, namely Mardan and Charsadda, to provide backup support to biological scientists, extension workers and policy makers. The main objectives were to assess farmers' perceptions regarding the adoption of chip bud technology, calculate the costs and revenues of the sugarcane chip bud method versus the sugarcane conventional method and identify constraints faced by farmers in adoption. Principal component analysis and logit regression model were used. Primary data was collected from both adopters and non-adopters of sugarcane chip bud technology through well-structured interview schedule. The empirical findings of the study revealed that the average operational land of adopter and non-adopter farmers was 15.52 acres and 10.90 acres, respectively. More than half (58.8%) of the sampled farmers received information regarding sugarcane chip bud technology from agricultural extension department followed by fellow farmers (27.5%), agricultural research institutes (5.9%), land owner (3.9%), sugar mills (2%) and internet (2%). On average, the sampled adopting farmers practiced chip bud technology for 1.48 seasons (ranging from 1 to 4 seasons). During the study, it was noted that the sugarcane chip bud technology is not being disseminated in accordance with its requirements while neglecting the recommended production techniques. Most of the adopter farmers planted chip buds directly in the field instead of raising chip buds nurseries. Sampled adopter farmers who directly sown chip bud on their farms allocated 0.74 acres of land to sugarcane direct chip bud method and 6.21 acres to conventional method. Adopter farmers who raised sugarcane nurseries and then seedling transplanted allocated 0.89 acres to the chip bud method, while 5.5 acres were allocated to the conventional method. Non-adopter farmers allocated 5.81 acres to the conventional method. Adopter farmers who planted sugarcane chip buds directly in the field reported an average germination rate of 54.74% and received an average yield of 270.84 mounds per acre. Those who transplanted seedlings reported a germination rate of 79.78% and obtained a yield of 649.25 mounds per acre. Non-adopter farmers who used sugarcane setts had a germination rate of 90.71% and received an average yield of 514.15 mounds per acre. The benefit-cost ratio was 2.69 for the sugarcane chip bud method (sugarcane transplanting through seedlings), 1.25 for the sugarcane direct chip bud method (sugarcane cultivated using direct buds sown in the field) and 1.95 for non-adopter farmers who cultivated sugarcane using the conventional method. The principal component analysis (PCA) grouped 30 variables into eleven components. The eleven principal components accounted for 79.954% of the total observed variation. The first component contributed 19.454%, driven by positive loading effects from variables related to sugarcane chip bud technology. The second component accounted for 13.734%, with major contributions from traditional farming practices and support services. The third component, comprising financial support and pest/disease risks, explained 8.736% of the variation. The remaining components contributed smaller percentages, highlighting issues such as tenancy status, high input costs, knowledge gaps, labor intensity, technology adoption challenges, and institutional support. The results of the logistic regression model analysis show that farm services centers membership and landholding are significant at the 95% level of confidence while education and sugarcane farming experience are significant at the 90% level of confidence on farmers'

decision to adopt chip bud technology in sugarcane crop. The adopter farmers reported that a lack of knowledge was the major constraint in adopting sugarcane chip bud technology, followed by laborious work, water scarcity, the method being time-consuming and more labor involvement. The non-adopter farmers cited a lack of knowledge as the main constraint, followed by unsuitable soil, laborious work and water scarcity during growing period. The study suggested that the agricultural research department should conduct research on sugarcane chip bud technology tailored to farmers' conditions, developing nursery raising techniques, reducing labor demands, and optimizing soil and irrigation practices. Concurrently, agricultural extension departments should launch awareness campaigns, provide training, establish demonstration plots, ensure the availability of chip bud machines, and maintain continuous monitoring and feedback systems. To support farmers, the government regulates input prices and provides subsidies, while research and extension departments should maintain close coordination for timely solutions to farmers' challenges.

Analyzing the role of public and private sectors in wheat seed system in Khyber Pakhtunkhwa of Pakistan

The agricultural sector's improvement, particularly through the adoption of improved high quality seeds of yielding varieties is essential for improving productivity and economic prosperity of Khyber Pakhtunkhwa. This study conducted during the financial year 2023-24 offers an in-depth analysis of wheat seed production system and agricultural practices of Seed Multiplication Plot's (SMP) farmers, emphasizing potential areas for improvement, productivity and sustainability in the province. The research draws on data from provincial agriculture departments, Federal Seed Certification and Registration Department Peshawar (FSC&RD), group discussion and direct interviews with seed production companies and SMP farmers of the selected districts. The study highlights the socioeconomics, farm practices and financial outcomes of SMP farmers, revealing challenges in seed accessibility and affordability. The provincial seed production system comprises both public and private sectors focusing on the development, testing, release, multiplication and distribution of new varieties. The province has numerous research institutes and agricultural farms (collectively 2336 acres) devoted to seed production and multiplication, with an emphasis on developing varieties and improving agronomic practices. FSC&RD oversees seed quality and certification, ensuring national standards. The public sector through Agriculture Research and Agriculture Extension Institutions collaborate with national and international organizations. The agriculture research system is vigorous, having multi-disciplinary research institutions and commodity specific stations that focused on developing high yielding, disease resistant varieties through conventional and non-conventional breeding techniques that were suitable for the province's diverse climate. The province has developed and released 70 wheat varieties along with 14 other wheat varieties having two biofertified varieties. The Agriculture Extension Department plays a significant role in transforming scientific research into practical applications, improving productivity, income generation, non-formal education and information dissemination to farmers mainly in remote areas. The Directorate of seed under the Agriculture Extension Department emphasized on systematic seed production, procurement, processing and marketing to provide high-quality seeds at affordable rates. The average yield per acre of SMP farmers was 30.22 mounds while the potential yield was 41.88 mounds. The benefit cost ratio was 2.23, excluding the cost of irrigation water and land rent. Despite progress, the overall wheat yield in the province remains below the national average. The data sourced from FSC&RD Peshawar shows that during 2023-24, the province yielded 17,762.15 tonnes of wheat seed, with the private sector contributing 70 percent. Major varieties grown were Pirsabak-13, Gulzar-19 and Pirsabak-19 that together dominated both cultivated area and production. Four-fifths of the area and production of wheat seed from the pre-basic category were attributed to Agriculture Research Department while basic, certified and approved wheat seed were predominantly produced by the Agriculture Extension department. The private sector plays a critical role in tackling the farmers' challenges in accessing improved seeds. According to FSC&RD records, 62 percent of the inspected area and 70 percent of the production was originated from the private sector. Private seed companies possessed substantial land for wheat seed production and collaboration with farmers, however, these companies were grapped with financial challenges, exacerbated by the current price hikes, high mark-up on interest that hindered their expansion in the business. The companies highlighted the need in terms of policy support, financial mechanism and trainings along with subsidy provision on inputs and for regular meetings. The total wheat seed requirement for the province was 92,817 tonnes with 52 percent for unirrigated land. There was deficit in certified seed availability, necessitating an additional 18,354 hectares of wheat production area to meet target given by Federal Committee of Agriculture for 2023-24.The findings emphasize the need for effective public-private collaboration, increased research funding, expansion of extension services and

policy development to enhance wheat productivity and profitability in the province. Addressing these gaps can significantly improve wheat yields and contribute to the socio-economic development of Khyber Pakhtunkhwa.

Trend analysis of area, production and yield of major food crops in Khyber Pakhtunkhwa of Pakistan

The primary food crops cultivated in Khyber Pakhtunkhwa province include wheat, maize, rice and sugarcane. However, investing in modern agricultural technologies and infrastructure in the province presents challenges due to recent economic crises, small landholdings and financial constraints faced by farmers. The government requires precise and advanced information regarding the status of key food crops. Growth and decline trends serve as common summaries of time series data trends. The insights into the growth performance of these selected food commodities would assist the policymakers in implementing appropriate policy measures. The production and yield of wheat crop increased significantly at 1.11 percent and 1.10 percent, respectively, while the area was non-significant during 2009-10 to 2021-22 in the province. Major districts like Swat, Mansehra, Dera Ismail Khan, Mardan, Charsadda, Swabi, Peshawar and Buner collectively contributing 57 percent of total wheat production. From 2009-10 to 2021-22, wheat production and yield have shown moderate but consistent growth rates. However, there are variations within districts, while the area has remained relatively stable. Similarly, production and yield of maize crop increased significantly at 1.06 percent and 0.62 percent, respectively, while the area remained non-significant during 2009-10 to 2021-22 in the province. Major districts like Swat, Mansehra, Mardan, Bunir, Swabi, Shangla and Kohistan collectively contributing 61 percent of total maize production. From 2009-10 to 2021-22, maize production and yield have seen significant increases, showcasing the province's commendable efforts in sustaining maize cultivation. Factors influencing wheat and maize production include water availability, impacted by rainfall patterns and the supply of essential inputs. The area, production and yield of rice crop increased significantly at 2.74 percent, 5.88 percent and 3.05 percent, respectively, during 2009-10 to 2021-22 in the province. Major districts like Dera Ismail Khan, Swat, Kurram, Dir Lower, Dir Upper and Malakand collectively accounting 70.41 percent in total rice production. From 2009-10 to 2021-22, the province has experienced notable increases in rice cultivated area, production and yield, indicating a positive trend in rice farming despite fluctuations in cultivated area. Water availability stands out as a crucial factor influencing rice production, with rainfall variability and droughts impacting yields. Similarly, production and yield of sugarcane crop increased significantly at 0.69 percent and 0.39 percent, respectively, during 2009-10 to 2021-22 in the province. Major districts like Mardan, Charsadda, Dera Ismail Khan, Malakand and Peshawar covering a substantial portion of sugarcane area and production in the province. From 2009-10 to 2021-22, the province has experienced notable increases in sugarcane production and yield. Water availability supported by sources like CRBC and Gomal Zam Dam, being crucial due to erratic rainfall and droughts. Ensuring timely availability, accessibility, and affordability of inputs like seeds, fertilizers, and pesticides through subsidies and effective distribution channels is crucial. Reductions in cultivated areas and conversions to other crops add complexity to sugarcane production dynamics in the region. Promoting improved crop management practices, implementing water management strategies, and enhancing irrigation systems are essential. Government support through policies, research, and development is necessary to address challenges and ensure sustainable production.

Research Articles Publication

Published in peer reviewed journals: 02

Article submitted to APAARI News letter: 01

Article submitted to Sarhad Journal of agriculture: 04

Research Projects 04

Two projects for ALP submitted and shorted listed for 10 batch

- Value chain analysis of exportable vegetables from Khyber Pakhtunkhwa, Pakistan" (proposal identification no. SS0068).
- Analyzing the level of Knowledge and Adoption of Recommended Production Technology of Plum and Citrus Fruits Growers in Khyber Pakhtunkhwa-Pakistan" (proposal identification No. SS0069).

Turkish Cooperation and Coordination Agency (TIKA) for the GEF-8 (2022-26) and star allocation for Pakistan Projects:

- Project proposals/concept papers entitled "Knowledge gap analysis of climate smart agricultural production technologies in Khyber Pakhtunkhwa, Pakistan" for the GEF-8 (2022-26) star allocation for Pakistan developed and submitted
- Project proposals/concept papers entitled "Promotion of Beekeeping Enterprise for sustainable livelihoods in Khyber Pakhtunkhwa, Pakistan" for Implementation of Small Projects by Turkish Cooperation and Coordination Agency (TIKA) developed and submitted.

Social Sciences Research Institute (SSRI), FAISALABAD

Budget Allocated	**Funds Released**	**Expenditure**	
PKR: 1800000	PKR: 1280000	PKR: 1274260	
Researched Reports Targeted	06	Research Reports Completed	06

Economic Analysis of Sweet Potato Cultivation in Punjab-Pakistan

Sweet potato is one of the world's most essential food crops due to its high yield and nutritive value. About 90 percent of the world production of sweet potato is from the developing countries; with China having the largest share of 72 percent. Sweet potato is a traditional vegetable crop of Pakistan and cultivated in this region since ancient times. The tuber of the crop is generally used for eating by adding spices to it or without it especially by the younger generation of the country. The leaves of sweet potato are consumed as vegetables and also used for animal feed. The area of sweet potato was 1637 hectares while the production was 14134 tonnes during the year 2021-22 in Pakistan as reported by Federal Bureau of Statics (FBS). This study was conducted in three districts i.e., Sheikhupura, Nankana Sahib and Faisalabad of the Punjab. Depending upon time, money and availability of farmers, Fifty-seven (57) respondents are interviewed directly through structured questionnaire. Gross margin analysis was applied to compute the economics of Sweet potato production. Total variable cost of sampled sweet potato growers is Rs. 72108.26 on per acre basis. Gross margin (GM) analysis reveals that it is Rs. 205,679 on per acre basis. There are three to five marketing channels through which sweet potato is marketed in the Punjab. The most prevalent marketing channel is selling through commission agents operating in major wholesale fruit and vegetable markets of country. It is proposed that new varieties of sweet Potato should be developed instead of customary white and red color tubers generally used for sowing purpose. Additionally, the complete production technology package for this traditional vegetable should also be developed for the guidance of the farming community in the Punjab-Pakistan.

Dwindling Sustainable Agricultural Food System in Pakistan: Current Challenges and Policy

Sustainable Agricultural Food System (SAFS) has been fundamental to basic human needs of food security, nutritional security, food safety/hygiene, good health, decent livelihood, nondiscrimination, equity and clean/healthy environment etc. SAFS is in the center of debate in relation to Sustainable Development Goals, 2030 (SDGs). The Agricultural Food System (AFS) in Pakistan is unable to deliver aforementioned basic human needs despite being an agrarian economy. A World Bank report issued in January 2023 reveals that six million people in Pakistan are facing acute food insecurity. Similarly, malnutrition is wide spread in the country and progress in this direction is far from satisfactory. Another, related problem is worsening situation of food safety/hygiene and quality in the country. The environmental condition is worsening day by day causing serious multifaceted problems for rural and urban population in Pakistan. There is scarcity of research on SAFS documenting its current status, identifying weaknesses, and covering its various socio-economic and environmental implications. Against this backdrop, the present research was designed that based on synthesis of pervious literature, key informant interview (KII) of relevant stakeholders involved SAFS processes in the country. The research reveals that AFS is unable to ensure food and nutritional security and also fail to sustain the socio-economic and environmental challenges involved in food production, marketing, processing, distribution and consumption in Pakistan. The low and middle income segments of population face many problems like difficult access to essential food items, higher food inflation, low quality food items and even unavailability of certain essential food items at times. There is less equity, social justice, human rights etc. in the food system operations prevailing in the country. The various SAFS dimensions including social (equity, social justice, human rights, ethics and power etc.), economic (poverty, rural livelihood, employment,

profitability and investment etc.), political (accountability, rule of law, conflict resolution and corporate ethics etc.) and environmental (greenhouse gases, water, soil, ecosystem and one health etc.) are declining in the country. This is happening amid significant efforts of the government with respect to budgetary allocation, institutional reforms, sectoral enhancement policies etc. designed and implemented overtime. The country is unlikely to achieve SDGs due to un-sustained progress of agriculture sector along with other sectors of economy. The foremost challenges hindering the sustained progress of AFS in the country include lack of implementation of agriculture sector policies on continued basis, high population growth rate, climate change, failure of import substitution policies, export restrictions, small agribusiness industry generating few agricultural value added products, unfair market practices and prolonged energy crisis in the country. The overall public support agenda towards SAFS is archaic which prevent the agri-food sector to ensure food and nutritional security. The government is unable to protect the interests of different stakeholders of AFS despite of the significant contribution of agriculture sector towards country's economy. Now, it is high time to reform agri-food sector in the country on priority basis towards diversity, competitiveness and resilience that contribute to improve economic growth, investment, employment, and above all food and nutritional security without disturbing the balance of natural resources for future generations. Therefore, it is suggested that public investment should be directed to support veracious agri-food sector activities that help to improve crop diversity, enhance production potential of food animals, development of suitable agricultural technologies and conservation of natural resources through innovative technologies in the country.

Consumer preferences towards edible oil purchasing decisions in Faisalabad

Consumer preference refers to decisions made by consumers to increase their satisfaction level in a product. In modern marketing, consumer satisfaction is a basic notion. Although consumers may pick some of the products they purchase, they are not always able to get exactly what they desire. In the present study, an attempt has been made to identify consumer awareness, satisfaction level and the factors influencing towards purchasing decisions for edible oil. Data were collected through well-structured questionnaire by random sampling technique from 200 respondents in Faisalabad. The study results depicted that educated respondents were more aware of the prices, brands, net weight and expiry date of the product. According to the study results 43% of respondents preferred sunflower oil followed by 18 %, 15%, 12.5% and 12% respondents preferred kisan cooking oil, dalda cooking oil, canola oil and mustard oil, respectively. The results regarding satisfaction level indicated that majority of the respondents (53.5 %) were satisfied with texture followed by consistency with 52.5 %. Satisfaction about taste and aroma was reported by 49.5% of the consumers. Based on Exploratory Factor Analysis (EFA), good quality, hygienic products, chemical-free, appropriate packaging and effective advertisements are the factors strongly influence the consumers to purchase Edible oil. Furthermore, these factors are important to ensure transparency and building consumer trust that influence consumer preference for edible oil. To attract more customers, the producers are recommended to ensure quality and focus on sustainable and chemical-free production methods.

Economic and financial analysis of bamboo production, processing and marketing in selected districts of Punjab

Bamboo as "the green gold of the forest" is ecologically, economically, socially and commercially has versatile uses for animals and mankind. It has more potential than the past in the coming future in terms of alleviating poverty and supporting the economy on account of enormous demand arising in local and foreign bamboo markets for its products. On one hand, development based on bamboo is being globally and locally promoted as an effective way to improve the livelihoods of rural poor people in bamboo growing areas because of available resource base of bamboo and the low cost-labor resources. On the other hand, the economic and financial feasibility to know long term profitability of this alternative crop in various commercial uses is limited in the context of Pakistan. In this background, present study attempts to assess the economics of bamboo production, processing and to explore the market potential of selected bamboo products in two prominent bamboo producing districts of PunjabProvince with the objectives such as estimating per acre costs and benefits of bamboo production over first and successive cultivation years, exploring potential of bamboo products for local and overseas market, and studying strengths, opportunities, threats and weakness faced to bamboo sector of the country. In order to attend objectives, approaches of assessing the economic viability of bamboo cultivation like Benefit Cost Ratio, Net Present Value and Internal Rate of Return were applied for finding the economic viability at a local discount rate of 21 percent. Similarly, the strengths, weaknesses, opportunities and threats facing the bamboo sector were explored with the help of all

stakeholders in order to propose relevant development-based action plans for bamboo sector in the country. According to study findings, the first bamboo crop normally becomes ready to harvest after 5 years of crop establishment. Subsequent bamboo cuttings with an interval of three years give the best raw material for processing. Based on economic viability analysis, the owner-farmers of bamboo were recommended to continue bamboo cultivation while rented-in farmers were guided not to come in the bamboo sector on current trends in the market. The estimated BCR, NPV of cash flows and IRR in case of owner farmers was calculated to be 2.12, Rs.180204 and 58%, respectively indicating that bamboo cultivation in study areas is a profitable enterprise for only those farmers who have their own land. On the other hand, same estimates of BCR= 0.90, NPV of cash flows= Rs.-258692 and IRR= -7% guided that non-owner farmers (farmers working on rented-in lands) should reject/not to enter the bamboo sector presently at a higher market rate of interest than return to invested amount. It could be concluded easily that the returns on bamboo cultivation are higher only for the farmers having their own land available for farming and they could earn a large profit if bamboo farms are cared and nourished with a commercial vision. Although few bamboo-based products for local consumers are coming in the market, yet huge potential exists in local, regional as well as nearby Afghan markets for improved and high value added bamboo product range. It is therefore, recommended that government research departments should provide newer bamboo varieties to farmers duly accompanied with production technology packages for all relevant stakeholders involved in value chain. It is solely on the part of the government to provide ease in doing business particularly by facilitating bamboo export through Pakistan-Afghan border. In this way, the bamboo farmers, processors and traders will benefit handsomely on the one hand while also contributing to Pakistan's foreign exchange reserves on the other hand. Last but not least, market consumer studies on bamboo products should be conducted to give feedback to bamboo industry for making demand-oriented products.

Who consume more broken rice grain? Evidence from rural and urban consumers

The present study in response to rising food prices was conceived to find quantitative differences, particularly in broken rice consumption concerning the geographic (urban/rural) location of the consumers. Seven districts namely Faisalabad, Sheikhupura, Kasur, Lahore, Sargodha, Khanewal and Toba Tek Singh were selected as a case study from Punjab Province. Cross-sectional data collected randomly from 400 consumers of broken rice (100 from Faisalabad and 50 from each of the remaining districts however, with equal proportion of rural and urban households from all seven districts) was used to run descriptive and non-parametric test of Mann-Whitney U-Test, an alternative test to student t-test based on data properties. Descriptive statistics show that the average monthly income of the households was Rs.83590 with an average monthly income of Rs.77285 and Rs.89895 for rural and urban households respectively. The overall total rice consumption per household (9.18 Kg/month) comprised more than half (57%) of broken rice (5.23 Kg/month). Despite comparatively lower family size and monthly income, overall rice consumption including whole as well as broke rice quantities were comparatively more in rural households although there was a non-significant difference for rural and urban households according to The Mann-Whitney U-test. Test further elaborated that urban households had comparatively higher monthly income/earnings with a highly significant difference in the monthly earnings. The reasons of slightly more consumption of rice among rural households may be linked to their comparatively higher likeness/preference for rice including broken rice as well as availability of more milk (for eating with rice) in rural settings. Presenting findings in another way, monthly wheat consumption of 38.46 Kg is less in rural than urban households. However, joint rice and wheat consumption trends (with 47 Kg monthly consumption) have important policy implications for ensuring household cereals-based food security in the country. Keeping in view rising broken use among households, it is suggested that large scale primary data on rice particularly broken rice categories should be collected for analysis to further validate findings for appropriate national-level policy. Keeping in view the role of rice similar to wheat flour in reducing food insecurity, studies finding the relationships between household income and consumption of rice including locally called pona, adhwaar, tota or mix type categories of broken rice are also suggested to deeply understand the consumer preferences for broken rice market in the country. In the meanwhile, commodity prices of rice similar to wheat grain should also be monitored in order to protect consumers of rice.

Economics and marketing of rapeseed and mustard in the Punjab

The government of Punjab has taken different steps for enhancing oil seed crop productivity including rapeseed & mustard by giving subsides on certified seed and fertilizer in the recent past. NARS system has also introduced new varieties of rapeseed & mustard having high yield potential and moderate resistance

against diseases. Parallel to this, a sharp increase in the prices of farm inputs, cost of production and the cost structure of various farm enterprises including rapeseed & mustard have changed significantly thus affecting profitability of the crops. Moreover, the marketing situation of rapeseed & mustard could not improve due to sharp decline in output prices during year 2022-23. In this background, present research worked intended to study the economics and marketing of rapeseed and mustard crops in selected pockets of Bahawalpur and Faisalabad. Primary data were collected from 200 randomly selected growers. Descriptive and partial budgeting techniques were applied to study survey data. Research findings reveal that farmers were quite experienced in farming and on an average had about 18 years of farming experience. The average family size was about 7.0 members out of which 1.79 male adults of the family were doing farming.The average land size was 25.67 acres and land rent was Rs. 66158.12 per acre. By covering 62 percent land area, wheat was the major rabi crop while rapeseed & mustard crops covered about 28 percent area in rabi season. The percent area allocated to rapeseed & mustard was relatively higher among small farmers as compared to other farm categories. Cotton was the major kharif crop covering about 38 percent of the total cropped area followed byrice, sugarcane and maize respectively. Per acre average cost of production estimates for rapeseed & mustard was Rs.77516.56. The inter-farm size comparison reveals that total cost of production is on higher side at small farms as compared to medium and large farms. The gross revenue from sale of rapeseed & mustard in Punjab was estimated as Rs.131001.23. The gross revenue was comparatively higher at small farms as compared with large and medium farms. The main reason behind this trend is higher yield on small farms which are mostly situated in Faisalabad district having good soil. The net returns of rapeseed & mustard production with land rent were Rs. 53484.68 with benefit cost ratio (BCR) of 1.69:1.00. The net returns of rapeseed & mustard production without land rent were Rs. 20405.61 with benefit cost ratio (BCR) of 2.95:1.00. On the basis of BCR, it can be concluded that growing of rapeseed & mustard is a profitable enterprise in the irrigated Punjab. On an average, 131.44 monds of rapeseed & mustard was produced at each farm level, out of which 4.20 mond (3.2%) is kept for home consumption whereas the rest i.e 127.24 mds (96.80 %) is marketed. Commission agent in the grain market with more than 69% share was the major market intermediary followed by local trader (beopari), who either purchased directly from the farm or were supplied by the farmers at 29.38 %. Only 1 % of the farmers directly sold output to oil expeller. Farmers got a higher price from local trader (beopari) and oil expellers. This may be due to better negotiation power of farmers as they were not bound to sell produce to specific commission agent in lieu of loans. Although the rapeseed & mustard production is a profitable enterprise, yet farmers are getting more returns from wheat (a competing crop). It is, therefore, recommended that efforts by the Government to decrease the input prices specially certified seed and fertilizer are necessary to make rapeseed & mustard more profitable. Similarly, yield enhancement with latest production technology and new varieties is also a good strategy at farm level.

Social Sciences Research Institute, NARC, ISLAMABAD

Budget Allocated	**Funds Released**	**Expenditures**	
Research Reports Targeted	22	Research Reports Completed	16

Mechanical Transplanting: A Viable Option to Enhance the Productivity of Rice Crop

The agricultural research and development initiatives have encouraged the transformation in the agriculture sector with increasing mechanization. Resultantly, the majority of the farmers in rice-growing countries have shifted to mechanical rice transplanting due to labour shortages or rice productivity prospects. The rice-growing farmers in Pakistan are still stuck or convinced with the conventional way of rice sowing. Foreseeing the labour shortage in the agricultural sector and productivity enhancement prospects, PSDP- Productivity Enhancement of Rice project management team marked the adoption of mechanical transplanting of rice at farmers' fields as one of the key interventions. In this perspective, to assess mechanical transplanting's impact on rice productivity, and to know farmers' perceptions about the adoption of technology, a field survey of thirty farmers who benefited from subsidized mechanical transplanters and nursery machines was conducted in the year 2023. It was found that beneficiary farmers obtained a 5.18 maund higher yield per acre (12.2%) with mechanical transplanting than their normal practice. The productivity per acre of the Super Basmati variety was higher (37.88) maunds against the normal practice (34.25) maunds. Similarly, for other basmati varieties viz. Kissan 1509, Kainat 1121, PK 386 productivity of the mechanically transplanted crops was higher (51.88) maunds against normal practice (46.00) maunds. Beneficiary farmers reported about the high

cost of machines, but the misconception that it is difficult to use is not the case. Farmers viewed that initial care at nursery transplanting is needed in the case of mechanically transplanted rice, as plant height is much less as compared to the conventional manual labour transplanting method. They stated that the mechanical transplanting cost is Rs. 1000 to 2000 per acre higher than the conventional method. Furthermore, laser levelling is mandatory for mechanical transplanting. Furthermore, laser levelling is a prerequisite for mechanical transplanting. While farmers recognized the technology's potential for labor and time savings, they noted that its adoption may be hindered by limited access to mechanical transplanters and some farmers' reluctance to change traditional practices. More knowledge dissemination through farmer field days by the extension department is suggested by the host farmers. They proposed more public support in the form of subsidy for upscaling the adoption, as prices of mechanical transplanters are very high. They further suggested technical support for the repair and maintenance of the transplanters. They also suggested on establishment of public sector facilitation centres for training of the machinery operators and labour involved in nursery raising and its translating.

Effectiveness of Demonstration Plots to Improve Farmers' Learning and Enhance Rice Productivity

Despite the increase in crop productivity over the years, Pakistan's agricultural productivity still falls below the potential and even low for major crops comparing the world average. The main factors hindering crop productivity are depleting soil fertility, pests and disease infestation of crops, climatic variability, and importantly low adoption of modern innovations to improve crop-specific agronomic management practices due to the low knowledge base of the farmers and poor performance of agricultural extension system. In this reference, under the public sector development project (PSDP) - Productivity Enhancement of Rice, different interventions are planned; to increase the number of rice plants per unit area with mechanical transplanting or line sowing method, provision of certified seed, and better weed management. The objectives of these interventions were; to improve farmers' knowledge and yield, the old one- the best agricultural extension approach i.e. setting up demonstration plots was carried out to enhance farmers' knowledge and increase the adoption of best agronomic management practices. To assess the effectiveness of demonstration plots, 72 farmers were interviewed in four main rice producing districts of Punjab's Rice-Wheat system viz. Gujranwala, Sheikhupura, Sialkot and Hafizabad. The results indicate that the yield and net returns per acre were higher at demonstration plots for basmati varieties including Kissan 1509, Kainat 1121, PK 386, Super Gold, etc., (56.37 vs 49.45) maunds and (73339 vs 54619) PKR comparing to the fields managed by conventional practices. Similarly, productivity and profitability per acre were also higher for the super basmati (43.19 vs 37.08) maunds and (38858 vs 20339) PKR, respectively. Farmers viewed that the increase in the number of plants due to line sowing method or mechanical transplanting, quality seed, balanced use of fertilizers, plant protection measures, and timeliness in agronomic practices management are the key learnings and contributing factors in enhancing the rice crop yield and net returns. Host farmers were convinced to replicate the demonstration plot learning at 30-35 percent rice area in the crop year 2024. In the same way, fellow farmers also took keen interest in the sowing method and balanced use of fertilizers. It implies that demonstration sites increased farmers' knowledge about recommended rice production technology and furnished an opportunity to get hands-on training on execution of field operations. It is suggested that all the concerned formal and informal research and development institutes/agencies should devise mechanisms for setting up more demonstration plots or using other extension methods to promote the adoption of mechanical transplanting and other best management practices to enhance rice productivity.

Dietary Diversity by Provinces and Administrative Divisions with Rural-Urban Divide in Pakistan

One of the biggest factors affecting human health and nutrition is diet. The study is based on Pakistan Social and Living Standard Measurement Survey (PSLM)/ Household Integrated Economic Survey (HIES) 2018-19 and PSLM 2013-14 with an objective to determine dietary diversity in Pakistan by provinces and administrative divisions with rural urban divide. The study has been carried out to fill the research gap, as the available literature on food security and dietary diversity in Pakistan and other South Asian nations primarily focuses on women and children under the age of five. This study is an attempt to cover geographical location wise determination of the dietary diversity in Pakistan. Changes in monthly per capita consumption of high value agricultural commodities from year 2013-14 to 2018-19 have also been determined. The findings of the study are important to suggest recommendations for food dietary improvement in the country. These can be used to develop policies and programs to target administrative divisions with low dietary diversity. It is found that consumption pattern of the people has changed to a substantial extent during the study period. Meat

consumption has increased a little in urban areas (1.0%) and decreased to a considerable extent in rural areas (9.3%). Egg consumption has decreased by 30.3% and 24.6 % in urban and rural area, respectively. While rise in consumption of both fruits and vegetables have occurred over time by more or less half kilogram per capita per month for each. Fruits and vegetable consumption increased by 43.3% and 14.8%, respectively. In the same way, monthly consumption of milk and milk products has increased by 0.55 kg (7.2%) and 0.37 kg (4.5%) per capita in urban and rural areas of the country, respectively. As per PSLM/ HIES 2018-19, people in Khyber Pakhtunkhwa has the most diversified food pattern followed by Sindh, Punjab and Balochistan. Over time i.e. 2013-14 to 2018-19, household dietary diversity has improved in all the provinces, except Sindh as a little downfall occurred in it. Household dietary diversity in Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh provinces improved the most in Quetta, Dera Ismail Khan, Dera Ghazi Khan and Larkana divisions, respectively.

Exploring the Impact of Rural Transformation on Food Security in Pakistan

This study is rooted in the analysis of Household Integrated Economic Surveys (HIES) to assess food security across administrative divisions, including provinces and the national scale, while exploring household characteristics. Utilizing data from two HIES rounds conducted in year 2013-14 and 2018-19, the research examines the proportions of high-value crops in total crop production, and non-farm employment in total employment in rural areas at the administrative division level. Employing Logistic regression analysis on the 2018-19 HIES data, the study gauges the impact of high-value crop production, non-farm employment, and farming household characteristics on rural food security. Notably, the analysis reveals an increase in nominal income and food availability in rural areas from year 2013-14 to 2018-19, with a substantial rise in the food-secure population from 76.31% to 90.31%. In this reference, Balochistan province exhibited noteworthy improvements, followed by Punjab and other provinces. In year 2018-19, Sibbi in Baluchistan was identified as the least food-secure administrative division, while Hazara in Khyber Pakhtunkhwa emerged as the most food-secure division in the country. The study highlights the positive influence of the mean age of the household, mean monthly income, and household size per adult equivalent on rural food security. These findings offer valuable insights into the intricate dynamics of rural food security and contribute to a comprehensive understanding of regional factors at play. Hence, it is imperative to control the population growth rate in order to elevate the average household age, as to raise earning hands per household and attain rural food security. Likewise, there is a need for the generation of off-farm employment opportunities and an increase in household income to bolster food security and reshape the rural landscape of the country.

Competitiveness of Selected Agricultural Commodities of Pakistan

Agriculture is not only important for Pakistan catering national food security; it is also an important source international trade. Pakistan is facing trade deficit has been widening overtime. Based on the research gap and importance of commodities in international trade, pulses crops i.e Chickpea, mung, mash and lentil and vegetables i.e potato, onion, garlic and tomatoes were selected. This study is based on secondary data. Policy Analysis Matrix (PAM) framework was used to measure competitiveness, comparative advantage, and protection for selected commodities. Analysis of competitiveness at import parity prices revealed that Pakistan has a comparative advantage in producing pulses as importance substitution crop in Punjab. The result implies that production inside the country is more economical than imports from abroad. Increasing domestic production can save precious foreign. There is need strengthen research and extension services for introduction of modern technologies for higher pulses crop productivity which ensure financial viability for growers. In the vegetables Potato, onion, tomatoes and garlic were selected for analysis competitiveness. Analysis revealed that potato, onion, tomatoes and garlic commodities remained importable and exportable for Pakistan. This shows that Pakistan has potential of export in these commodities by increasing the competitiveness in these commodities. Pakistan is net importer in garlic, and tomato however in onion and potato Pakistan remained net exporter during 2021-22 period under analysis. The analysis revealed that production of all selected vegetables in the country to meet the local demand is more economically viable then import. There is a need to implement import substitution policies especially for pulses to promote local production in the country to save precious foreign exchange. Resource use efficiency in the local production of selected crops need to be enhanced.

Comparative Agriculture: Pakistan, GCC and Selected Central Asia Republics

This study was designed takes a comprehensive look at comparative agriculture of Pakistan and two regions i.e Gulf Cooperation Council (GCC) and Central Asia Republics (CARs) region. The region represents a diverse group of countries in terms of agriculture, economy, culture, and population. Pakistan and the GCC countries face distinct challenges and employ different strategies in agriculture, the common goal of achieving food security and sustainability drives their policies and investments in the sector. Understanding these differences and similarities can provide valuable insights into optimizing agricultural practices and policies in each region. Pakistan faces a US$ 11.5 billion trade deficit with the GCC, as Pakistan exports commodities worth US$ 2.8 billion to the GCC while importing worth US$ 14.3 billion worth of goods. Overall Pakistan remained net importer with a US$ 39.1 billion trade deficit with the world. By using secondary data a comparative agriculture analysis was conducted. To analyze trade status and potential, Revealed Comparative Advantage (RCA) was measured for agriculture products in selected regions. Agriculture contributes significantly to GDP with 22.7 percent whereas most of the GCC members have less than 1 percent agriculture contribution in GDP. In Pakistan land ownership is fragmented land ownership hampers economies of scale whereas in GCC land ownership centralized ownership and government-controlled agricultural projects. In Pakistan Technology Adoption based on mix of traditional and modern techniques; increasing focus on modernization whereas in GCC high investment in advanced technologies to overcome natural constraints (e.g., desert farming, controlled environment agriculture etc). The study results revealed that Dairy produce, edible vegetables, edible fruits and preparations of cereals, Pakistan showed revealed comparative advantage in GCC region. Looking at the individual agriculture commodities, Pakistan also secure regional RCA in meat, rice, Mangoes, guavas and mangos teens, Tangerines, mandarins, clementine's, Potatoes in most of the GCC countries. However, the present volume of Pakistan's trade with the Gulf countries is well below its potential. In conclusion, while both Pakistan and the GCC countries face distinct challenges and employ different strategies in agriculture, the common goal of achieving food security and sustainability drives their policies and investments in the sector. Understanding these differences and similarities can provide valuable insights into optimizing agricultural practices and policies in each region. Pakistan's comparative agriculture analysis revealed that Pakistan remained secures US$ 41 million trade surplus with the CARs, As Pakistan exports commodities worth US$ 167 million to the CARs while importing US$ 125 million worth of goods during 2022.. Regional Revealed Comparative Advantage (RCA) of Pakistani agricultural products in CARs region demonstrated that during 2022 edible vegetables, edible fruits, dairy and preparations of cereals categories in order. In the products, citrus, strawberries, grapes, potatoes and tomatoes have RCA. Improving connectivity, enhancing infrastructure, and ensuring political stability in the region are crucial steps towards fostering deeper economic ties and realizing the full trade potential between Pakistan and the CARs.

Pakistan's Agricultural Terms of trade: An empirical analysis

Changes in Terms of Trade (ToT) for the agriculture sector are of great importance for the economic prosperity of an agriculture-based economy. The terms of trade for the crop sector are defined as the ratio of the indices of prices received by the crop sector and the prices paid by the sector. Changes in the terms of trade have significant consequences not only for the agriculture sector but also for the overall economic growth of the country as agriculture sector accounts for almost one-fourth of the total GDP. The overall objective of this study was to work out terms of trade for Pakistan's crop sector to reveal how the sector has performed over time in terms of profitability and to assess impact of price changes on living standard of the farmers in Pakistan. The results show that there is an overall increasing trend in Producer Price Index (PPI) from 12.11 in 1991 to 306.58 in 2023. Notable increases are observed in recent years, particularly from 2019 to 2023. The index of prices paid by farmers (PFI) on consumer goods also shows an increasing trend, from 11.66 in 1991 to 291.16 in 2023. The rate of increase appears to accelerate after 2005. The Input Price Index (IPI) also shows an increasing trend from 14.28 in 1991 to 178.92 in 2022. The overall upward trends in PPI, PFI, and IPI reflect general inflation and increased costs within the agricultural sector. The ToT, calculated as the ratio of PPI and PFI, fluctuates but generally remains around 100, indicating a balanced terms of trade for much of the period. There are periods indicating unfavorable terms of trade for farmers. However, recent years (2018-2022) show an improving trend. The ToT calculated as the ratio of PPI and IPI reveals variability but has increased significantly in recent years, reaching a peak of 161.59 in 2020. PPI is increasing at a faster rate than the IPI in recent years, potentially indicating better profitability for farmers. The results of the study suggest implementing policies to stabilize both the PPI and PPF to reduce the volatility faced by farmers.

Targeted subsidies for critical inputs like seeds, fertilizers, and machinery are also suggested to reduce the burden on farmers and help to maintain a favorable Terms of Trade.

Impact of Foreign Direct Investment (FDI) in Agriculture Growth: Low- and Middle-Income Countries
Agriculture is a pivotal sector for developing countries: it represents an important weight in the developing countries' economy. The sectors react as important keys in the expansion of any economic growth to eliminate the poverty issues. The capital flows are likely to have profound impacts on the agriculture sector in countries across the globe. However, there remains limited literature on the role of capital inflows in the agriculture sector in low- and middle-income countries. Therefore, the study aims to examine the role that foreign capital inflows in the growth of the agricultural, forestry, and fishing sectors in low-middle income countries by using the panel data analysis. The random and fixed effect econometric model has been applied to estimate the effect of FDI on agriculture growth in fifteen countries from the year 1980 to 2022. The growth in the agriculture sector is the outcome variable and foreign direct investment is the focus variable and control variables are GDP growth rate, poverty, inflation, and logistic performance index. The results indicate that the effect of FDI has a positive and significant effect on agriculture growth in the countries in the model. However, poverty and inflation rates have adverse effects on agriculture growth. The Gross capital formation which determines the market size, infrastructure index, and exports has a positive and significant effect on agriculture growth. This implies that FDI has a positive impact on value added in agriculture, forestry, and fishing. However, enhancing factors like market size, infrastructure index and growth in exports will lead the agriculture growth in the country. Therefore, it is concluded that the government should be focused on the policies that bring the capital inflow to the country and pay attention to all the determinants, particularly for the reduction of poverty, inflation and market size of the agriculture sector to enhance the agriculture growth.

Future prospectus and Constraints of Entrepreneurship at Chakwal site; A Policy Implication for Sustainable Agribusiness Growth in Smallholder Farmers
More than one billion people in developing countries live in poverty. The main source of income and livelihood for many poor people in rural areas comes from agricultural activities in these countries. The literature indicates that the agricultural sector is one of the most important sectors in developing countries in need of sustainable entrepreneurship to improve the livelihood. Therefore, the research is designed to identify the constraints and opportunities of farm entrepreneurs at Chakwal site. The primary data was collected from the farmers and seed bank owners through the focus group discussion and key informant interviews in two villages (Akwal and Kot Sarang) in Chakwal. The results indicate that the livelihood of the farming community in Chakwal depends on 50 percent on agriculture (Crop and livestock) and 30 percent on off-farm income. During the focus group discussion, it was identified that mainly farmers are in the pre-establishment stage of entrepreneurship; however, few farmers are working on the establishment stage in project sites where farmers have basic skills to negotiate with middlemen and other value chain actors to get better prices. Furthermore, the seed bank owners are in the early growth stage where the farmers decide to take their new enterprise beyond survival, and they want to grow and establish the seed companies and develop linkages with the processes and high-end market. The poor infrastructure, unsupportive laws and regulations, lack of financial support, social and cultural barriers, lack of support and training especially for youth and uncertainty in the market are the major constraints faced by the farmers in the village. Effective and adequate entrepreneurship policies and programmes like promoting entrepreneurship education should be developed for young farmers for growth and development in the area.

Forecasting Production of Essential Food Crops in Pakistan
This research study investigates the production trends and forecasting for ten key essential food crops in Pakistan: wheat, rice, sugarcane, tomatoes, potato, onion, mung, mash, masoor, and gram. By examining historical production data and applying various forecasting models, the study identifies production trends and predicts future production levels. Six forecasting models were used to determine the best fit for essential food crop production in Pakistan, including: Linear trend model, Quadratic trend model, Exponential growth model, S-curve model, Single exponential smoothing model and Double exponential smoothing model. The forecasting models were evaluated using three accuracy measures: mean absolute percentage error, mean absolute deviation, and mean squared deviation. Lower values of these measures indicate a more reliable model with fewer errors. The findings reveal significant variations in mean production levels across crops and highlight the importance of understanding historical production trends to inform agricultural planning and

resource allocation. The S Curve model was identified as the best-fitted model for wheat forecasting, while the Quadratic Trend model proved most suitable for rice and sugarcane. The Double Exponential Smoothing model was selected for tomato, onion, mung, and mash forecasting and, the Single Exponential Smoothing model for masoor and gram. Exponential growth model was the best-fitted model for potato production in Pakistan. The study emphasizes the significance of selecting appropriate forecasting models and incorporating accuracy measures to evaluate model performance. Recommendations for future research include exploring the impact of external factors, such as climate change and government policies, on crop production and investigating the potential of advanced technologies, like precision farming and machine learning algorithms, for improving crop forecasting accuracy. This research provides valuable insights into the production trends and forecasting of essential food crops in Pakistan, offering a foundation for accurate forecasting, efficient resource allocation, and informed decision-making in the agricultural sector. The results can assist policymakers and agricultural planners in preparing for future production levels and ensuring food security for the population. In conclusion, this study offers valuable insights into the production trends and forecasting of essential food crops in Pakistan, providing a foundation for accurate forecasting, efficient resource allocation, and informed decision-making in the agricultural sector.

Virtual Nutrients Trade in Selected Agricultural Commodities of Pakistan

Virtual nutrient trade refers to the concept of transferring nutrients across regions or countries through the trade of agricultural products. When any region import food, they are effectively importing the nutrients that were used to produce that food, which can impact local nutrient cycles and agricultural practices. This trade can have both positive and negative implications for sustainability and food security. On one hand, it can help regions with nutrient deficits acquire the necessary nutrients; on the other hand, it may lead to nutrient depletion in exporting regions. Nutrient flows are important economically as well as environmentally. Based on the production and consumption data, estimation of the amounts of N, P, K, Calcium, Sulfur and gypsum embodied in selected agricultural commodities is obtained. It was obtained by multiplying the nutrient content of each commodity by the corresponding production and consumption volumes of all the provinces of the country to determine the flow of virtual nutrients from one region to the other by manipulating the difference between the nutrient use in production process and the nutrients used in the consumption process. The result will show the receiving regions, inflow of virtual nutrients or importing or deficient regions in case the sign is negative. On the other hand if the difference between the nutrient use in production and nutrient use in consumption is positive the region is called the surplus region in terms of nutrients, exporting region or region having outflows of surplus nutrients. In order to calculate the interprovincial transfer of virtual nutrients from one province to another five major agricultural commodities were selected based on the availability of the desired data i.e. wheat, rice, maize, cotton, and sugarcane for all the provinces of Pakistan for the year 2021-22. The research results provided the magnitude and direction of the virtual nutrient flows from one province to other. Punjab province was found to be the net exporter of nutrients in thousand tons for major agricultural commodities (wheat 656680, sugarcane 190386, cotton 404069, maize 298033, and rice 2541198). The KPK province was found to be a net importer of virtual nutrients for wheat in thousand tons (-270553), sugarcane (-18596), cotton (-52554), and rice (21382). Sindh province was found to be importing virtual nutrients in thousand tons for wheat (-31534), and maize (-340529). Balochistan was found to be importing nutrients virtually for wheat (-11991), sugarcane (-19471), cotton (-3655), and maize (-79096). It is suggested to encourage the implementation of sustainable agricultural practices in nutrient-deficient regions to enhance local nutrient availability and reduce dependency on imports. This could include improved crop rotation, organic farming, and the use of bio-fertilizers. Develop programs that promote the recycling of nutrients within regions, such as composting and the use of animal manure, to help restore nutrient balance and minimize the negative impacts of nutrient outflows.

Comparative Analysis of Agricultural and Rural Development in Cholistan (Pakistan) and Rajasthan (India)

The Thar Desert has significantly influenced the dry and semi-arid climates of Cholistan, Pakistan, and Rajasthan, India. The harsh weather, little rainfall, and recurrent droughts in these areas pose serious obstacles to agriculture. The production of crops like wheat, mustard, and cotton was made possible in Rajasthan by creation of the Indira Gandhi Canal and the addition of high efficiency irrigation techniques to the traditional rain-fed farming methods. Raising livestock is still a vital source of income in both desert ecologies. Due to its hard climate and lack of water, Cholistan has historically relied on nomadic pastoralism with little agricultural

planting. In an effort to improve food security and livelihoods, Cholistan has recently focused on drought-resistant crops, better water management, and sustainable farming techniques. This review report aimed to compare agricultural and rural developments in the Rajasthan Desert (India) with the Cholistan Desert (Pakistan) to promote agricultural practices and technology developments leading to productivity and livelihoods improvement in both deserts. The review revealed that with the help of significant government initiatives and research centers like CAZRI and IARI, Rajasthan became a leader in the adoption of cutting-edge technology like block chain, artificial intelligence, and automated irrigation systems. There is now much more water available and agricultural production in the area to important projects through the Indira Gandhi Canal irrigation project. On the other hand, Cholistan remained more dependent on conventional methods mixed with new technologies like solar power and animal farming done with precision. There is a heavy emphasis on community-driven solutions and a widespread use of sustainable practices, such as conventional methods of water conservation and soil moisture management. Socioeconomic variables indicate that Cholistan still suffers issues with healthcare, education, and economic diversification compared to Rajasthan. Overall, the development of infrastructure and integration of technology in Rajasthan demonstrated massive agriculture and rural development compared to traditional knowledge and limited adoption of improved practices in Cholistan, underscoring the necessity of specialized interventions to improve agricultural productivity and resilience in arid region of Cholistan, Pakistan.

Pakistan Dietary Guidelines and Nutrients' Consumption: An Exploratory Analysis

Diverse and healthy diet is crucial for developing high-quality human resources, and the Pakistan Dietary Guidelines (PDG) aim to promote healthy eating, reduce malnutrition, and prevent diseases. Despite this, a significant percentage of households in Pakistan face undernourishment, with higher rates in urban areas and nearly 40% of children experiencing stunted growth. Unhealthy dietary practices contribute to malnutrition, child mortality, and economic losses, while consuming energy-dense foods leads to overweight, obesity, and chronic diseases. This report provides an in-depth analysis of key nutrients consumption patterns across four provinces in Pakistan: Khyber Pakhtunkhwa (KPK), Punjab, Sindh, and Balochistan. The study aims to identify regional and socio-economic disparities in dietary habits, informing nutrition policy and programming. The study utilized comprehensive dataset of HIES 2018-19 to examine key nutrient consumption patterns from the household consumption of cereals, meat, pulses, milk and dairy products, fruits, vegetables, oil and ghee, sugar and sweeteners, and spices and condiments. Cereals dominate food consumption in all regions (30-40%), with significant variations between urban and rural areas. Meat consumption is relatively low (2-5%), with higher consumption in KPK and Punjab. Pulses, milk and dairy products, fruits, and vegetables exhibit varying consumption patterns across provinces. Oil and ghee consumption is higher in Balochistan, while sugar and sweeteners consumption are higher in Sindh. Spices and condiments consumption is relatively consistent across provinces. The inter provincial comparison revealed that KP has higher cereal and meat consumption with lower milk and dairy consumption. While milk and dairy consumption was relatively higher in Punjab with lower fruit and vegetable consumption. Sindh shows higher fruit and vegetable while lower cereal consumption. The Baluchistan consumes more oil and ghee and less pulses. Furthermore, the results revealed that the average daily consumption of essential nutrients across four provinces in Pakistan is lower than the Recommended Daily Allowance (RDA). Significant variations were found in nutrient consumption across provinces and urban-rural areas, with many populations falling short of the recommended daily allowances for essential nutrients. Iron, Zinc Vitamin A and Iodine intake was below the recommended daily allowance (RDA) in all provinces. Protein consumption was higher in KPK (25.93g) and lowest in rural Balochistan (19.91g). Beta-carotene consumption is highest in urban Punjab (1.41mcg) and lowest in rural Sindh (0.02mcg). Calcium consumption is highest in urban KPK (86.76mg) and lowest in rural Balochistan (66.19mg). Thus, understanding these patterns is crucial for informing nutrition policy and programming to address specific provincial needs, ensuring equitable access to nutritious food for all populations.

Comparison of Retail Markets, Weekend Bazar and Model Bazar for Fruits and Vegetables in Islamabad and Rawalpindi

Vegetables and fruits are essential sources of numerous nutrients and serve as important component of daily food consumption. In Pakistan, household expenditure on vegetable s and fruits consumption has increased over the years; however, consumers have diverse purchasing behaviors when it comes to select the market for their vegetable and fruit purchases. This study aimed to explore the factors influencing consumers' choices of

specific markets for buying vegetables as well as to compare and rank these factors across different market types, specifically retail markets and weekend markets. The findings indicated that retail markets capture a significant share of customers compared to weekend markets. The analysis revealed that the quality of vegetables and the distance to weekend market were the most critical factors driving consumer' choice of market for fruits and vegetables purchase. In addition, the consumers preferred the retail market due to daily availability fresh fruits and vegetable as well as other daily necessities. On the other hand, weekend markets were preferred by the consumers looking to purchase bulk quantities due to their larger family size compared to retail market consumers. Additionally, consumers placed considerable emphasis on the time required to travel to weekend market and the distance from their homes while making purchasing decisions. Furthermore, other notable factors included household income and family size, which also played a role in selection of market for fruit and vegetables purchase. Interestingly, access to organic and pesticide-free vegetables and fruits did not appear to be a significant concern for consumers in this context. The insights gained from this study have important implications for the marketing system and for entrepreneurs operating within retail markets, as they highlight the key factors that influence consumer behavior and preferences in vegetable and fruit purchasing.

Factors Contributing to Poultry Retail Price Hikes in the Rawalpindi, Pakistan

Poultry sector is one of the most important segments in livestock sector of Pakistan. Despite its growth, the sector faces numerous challenges, including fluctuating prices and rising production costs, which have hindered its development. The present study was conducted to evaluate the impact of various factors to influence the price of poultry meat in Rawalpindi, Pakistan. Through the analysis of data gathered from diverse sources, including surveys of poultry farmers and expert insights, it was found that poultry is primarily raised in two types of sheds: open sheds and controlled sheds. Large number of producers are in the market. However, the market is now witnessing a decline in open shed poultry farming, significantly impacted by the COVID-19 pandemic, which has led many small and medium-scale farmers to exit the industry due to substantial losses. Consequently, the number of farmers using open sheds for poultry meat production has drastically decreased, almost negligible with most birds now being raised in controlled environments. Now the open shed farmers for poultry meat are almost negligible, now the birds are reared in controlled shed only. Additionally, the price of feed has surged following the GMO controversy, along with increased costs for day-old chicks and soaring electricity bills. The availability of untrained labour further exacerbates production costs, ultimately driving up poultry meat prices. There is the need of proactive government regulations, continuous market monitoring, and strategic policies to support the poultry farmers. Such measures would alleviate the challenges arising from price fluctuations and help protect consumers' purchasing power. The increasing prices of livestock products (animal-based protein products), including meat, fish, eggs, and poultry, have become a significant concern in Bangladesh. This research is done to find out the root causes of the price hikes within the livestock products. The research also explores potential strategies for resolution. The study investigates key factors behind the price hike, identifies responsible parties, analyzes the overall cost of production, and proposes effective supply chain management improvements in Bangladesh. By analyzing data collected from various sources, including consumer surveys and expert opinions, the research paper highlights how factors like feed expenses, syndicates, inflation, global conflicts, and the COVID-19 pandemic greatly affect price fluctuations of livestock products. The study emphasizes the necessity for proactive government regulations, continuous market monitoring, and strategic policies to control price hikes and reduce the adverse effects on consumers' purchasing power. Through this comprehensive analysis, the research paper aims to find out the complex entities that contribute to the price hike of livestock products (meat, eggs, poultry, fish, etc.) and provide suggestions to mitigate the adverse situation. The increasing prices of livestock products (animal-based protein products), including meat, fish, eggs, and poultry, have become a significant concern in Bangladesh. This research is done to find out the root causes of the price hikes within the livestock products and their supply chain. The research also explores potential strategies for resolution. The study investigates key factors behind the price hike, identifies responsible parties, analyzes the overall cost of production, and proposes effective supply chain management improvements in Bangladesh. By analyzing data collected from various sources, including consumer surveys and expert opinions, the research paper highlights how factors like feed expenses, syndicates, inflation, global conflicts, and the COVID-19 pandemic greatly affect price fluctuations of livestock products. The study emphasizes the necessity for proactive government regulations, continuous market monitoring, and strategic policies to control price hikes and reduce the adverse effects on consumers' purchasing power. Through this comprehensive analysis, the research paper aims to find out the

complex entities that contribute to the price hike of livestock products (meat, eggs, poultry, fish, etc.) and provide suggestions to mitigate the adverse situation.

Social Sciences Research Institute, TANDOJAM

Allocation	Released	Expenditure	
PKR: 2000000	PKR: 1420000	PKR: 1420000	
Research Reports Targeted	04 reports	Research Reports Completed	02

Impact Assessment of Zero Tillage Wheat Sowing Technology in the Rice-Wheat Farming System of Sindh Province

The study was carried out through a primary as well as secondary data collection from various stakeholders to see which factors are mostly affecting the adopter, dis-adopter and non-adopter growers of zero tillage technology in rice-wheat system of the study selected area also to compare and evaluate the cost and crop yield per acre of wheat crop by using conventional and zero tillage technologies, to examine the cost benefit ratio and its constraints and recommendation were identified during the survey. The future prospects of the technology was higher adoption was found in study area but non-adopters of zero tillage technology farmers reported the not adoption due to upper land, shortage of irrigation, limited land, less production and not awareness in study area. Results showed that sample respondents of zero tillage adopters and non-adopters had more than overall own land was 12.05 acres, whereas overall total operational holding was 9.77 acres. The technology assessment for adopter farmers they did attend some farmer's field day but not aware of ZT Drill before attended this field day. The farmers reported the many benefits of use zero till technology was found but some main benefits like high yield and low expenses in the study area. The compare the yield with farmer practices and evaluate performance the yield among ZT Drill. Further results revealed that the some farmers note down the yield separately of adopters and farmer practice and difference of yield was 5.47mds per acre higher from farmer practices. The impact of zero tillage technology mostly adopter farmers of cost of production was improved followed by non-adopters farmers and some adopter farmers was no affect followed by decreases/worsened of cost of production. Further results revealed that food security of adopter farmers was improved and some adopter farmers of food security were no affect in the study area. It was found during the survey that some farmers of zero tillage adopters received higher net income as compared to non-adopters. Further Results show that the three important perception of adopter of zero tillage technology were saving of cultivation cost, saving time in sowing (Timely sowing) and more yield in study area. During the survey results show that farmers faced many constraints to adoption of zero-tillage drill technical such as lack of credit facilities for purchase of Zero tillage, poor financial resource base and lack of awareness and information.

Relationship between Equity in Irrigation and Crop productivity in Sindh, Pakistan

The study aims to find out the correlation between equity in irrigation and productivity levels among the Farmers in Sindh, Pakistan. By means of a comprehensive survey, we examine different aspects such as farmer demographics, land, and number of people in the farmer's household, mode of irrigation, performance, water supply, revenue, and costs. The purpose is to establish the relationship between the distribution of irrigation water and crop productivity. The analysis revealed significant disparities in irrigation water access and productivity across locations. Tail/ Downstream farmers, despite lower water access, as compared to upstream and middle farmers. Factors such as farm location, water quantity, and training significantly influenced crop output. The result shows that the farmers located downstream had the lowest access to irrigation water, as indicated by all the water accessibility indicators (reliability, equity, adequacy, and satisfaction) used in the analysis as compared farmers in the upstream and middle. Results shows a significant difference in irrigation water use between the upstream and middle farmers at a 1% probability level. The results also show that the upstream farmers used more water than the downstream farmers at a 1% probability level. These findings showcase that the downstream farmers used less irrigation water than their upstream counterparts. The upstream farmers had a spatial benefit for appropriating more water. Additionally, the results show a statistical difference in the irrigation water use between the middle and upstream farmers. Study indicated no significant difference between the wheat output of middle and downstream farmers. However, there was a considerable difference between the downstream and upstream farmers. This is

consistent with other findings, which reported a significant difference in crop yield between upstream and downstream farmers in various regions. The considerable difference between the farmers' output in the middle and upstream locations of the canal indicates that crops are mainly stressed during periods of water scarcity, leading to poorer production and poor performance downstream. Low productivity, low cropping intensity, and low profitability indicate significant volatility and revenue instability in their farming.

Social Sciences Research Institute, SARIAB, QUETTA

Allocation	**Released**	**Expenditure**	
PKR: 1200000	PKR: 852000	PKR: 594262	
Research Reports Targeted	04 reports	Research Reports Completed	04

Aquaculture and Fisheries Promotion in Livelihood Option in Gwader (Baluchistan)
Research design in this research was used as cross-sectional research deign. Likert types of scale was used in this research. Primary data (face-to-face interaction) was obtained at actual field level. However, 80 respondents were selected by using the random sampling. Data was analyzed by SPSS-25. T-test was used based on 95% confidence interval for mean score. Significant differences were observed in various items. Most of the department staff did not paid the regular visits. Most of the respondents sell their fish commission agents and others fish farmers. Most of the respondents sell out their fish within village and outside district respectively for better price. Majority of the respondents sell out their products in farm gate and other alternate places, however, majority of the respondents sell out their fish in other large wholesalers, small-scale wholesales, street vendors, retailers and supermarkets through cash. Majority of the respondents faced a problems regarding selling out their fish and having obstacle for marketing side.

Prospect of Olive Production and Its Product in Loralai District, Balochistan
Olive is one of the major crop in Loralai region. Now a day the momentum is building regarding the olive promotion at commercial scale. A various limiting factor as faced by the farming communities as shown in this research. In this regard, a diverse recommendations and suggestions put forward. In order to facilitate the farming communities in the terms of financial aspects, the government should provide the loan on subside rate. Extension Wing should be run the campaign regarding olive promotion for socio-economic acceleration for farmers.

Dates Palm Value Chain in Kech District (Balochistan)
Current study endeavors to determine the value chain associated with dates in the domestic market and also measure this system actor's perception. A paramount emphasis is placed on orchestrating an optimal performance of the dates value chain by integrating all actors involved, focusing on aligning strategies with consumer value preferences. In this regard, quantitative research design was applied. Kech district was selected. Random sampling was used in this research. Variables are two groups such as predictor variable or independent variable (IV) and criterion variable or dependent variable (DV). Thus, Statistical Package for the Social Sciences was used for information breakdown. ANOVA program was also run. Results shows that more than half of the farmers (55%) farmers were fall into age category 36 to 50 years of age. Most (43%) of the farmers were illiterate. Majority (90%) of the farmers were preferred joint family system. Vast majority (87%) of the farmers were married. Vast majority (88%) of the farmers preferred joint family system. Vast majority (72%) of the farmers having 21 and above years of farming experience. Majority (65%) of the farmers were of the view that they were used the dates for common, ordinary or daily uses as diets purposes. Most (55%) of the farmers were of the view that they were get the unreliable prices of dates. Majority (80%) of the farmers were of the view that they were negotiate with dates trader. While only 20% of the farmers were of the view that they did not negotiate with dates traders. ANOVA with in terms of LSD test was applied in order to detect the perception variations of the dates farmers. Following recommendations were mentioned that credit schemes should be announced by the government for farmers in order to raise their income level. Incentives schemes should be stimulated and upheld based on efficiency by the provincial government for EFS at department level.

Comparison Effects of Lintel and Wheat Crops Production in Rainfed Areas of Balochistan Surab District

Cross-sectional design was used in this research. Eighty respondents were selected. However, asking questions was another appropriate technique in this research. Eye-to-eye communication was applied. Results shown that most of the farmers (69%) were illiterate. Most of the farmers (44%) were 31 to 40 years. In this study we observed that the cost of production of wheat enhanced. The present study, therefore concludes that farm inputs are direct influence. A well planned policy should be formulated for aptly supply of farm inputs so as increases the farm production.

PLANNING AND DEVELOPMENT

Public Sector Development Program

Preparation, Scrutiny, and Processing of New and Modified Development Project:

Following nine (**09**) Project Concept Notes (PCNs) were submitted to M/o NFS&R for inclusion in PSDP for the FY 2023-24:

- Pakistan-Korea Joint Program on Certified Seed Potato Production System
- Genetic Improvement of Livestock for Productivity Enhancement.
- Research and Development of High Value Horticulture Crops in various Ecologies of Pakistan.
- Development and Promotion of Urban and Peri-urban Agriculture Models for Improving Food Safety and Livelihood.
- Establishment of Arid Zone Research Centre Bahawalpur to Support Food Security and Poverty Alleviation in the Desert Areas of Southern Punjab.
- Scaling up of Quality Honey Production Technologies under Different Ecological Regions.
- Genetic improvement program for the cultureable fish species in Pakistan & Establishment of National Reference Lab for Control of Fish Diseases.
- Induction of high value date palm varieties and establish processing plant to revenue increase by export for Pakistan.
- Development of the high value camel milk powder to earn foreign exchange and improve livelihood of arid area of Pakistan.

➢ Appraisedand scrutinizes**32 project concept proposals**andsubmitted under the "Emergency Food, Agricultural Supply and National Agricultural & Food System"by Islamic Development Bankforum for the F.Y 2023-24 (**Annexure I**).

03 project concept proposals were submitted for consideration underPublic-Private Partnership (PPP) Mode 2023-24 (**Annexure II**).

The projects prioritized/recommended for budget allocation during F.Y. 2023-24 are as under:

On-Going Projects:

- Commercialization of Potato Tissue Culture Technology in Pakistan.
- Productivity Enhancement of Rice.
- Productivity Enhancement of Sugarcane.
- Productivity Enhancement of Wheat.
- Promoting Research for Productivity Enhancement of Pulses.
- Sino-Pak Agricultural Breeding Innovations Project for Rapid Yield Enhancement.
- Mainstreaming of Mountain Agricultural Research Centre (MARC) for thePromotion of High Value Agriculture in Gilgit-Baltistan.
- Pak- Korea Joint Program on Certified Seed Potato Production System.

Principally Approved New Projects:

- Prime Minister's Initiatives For Green Revolution 2.0
- Horticulture Support Program.

New Projects for FY 2024-25:

- Research for Innovations in Agricultural Development (RIAD).
- Endowment for National Agricultural Research System - to support R&D with Long-Term Financial Stability (ENARS).
- Establishment of Animal Bio-Safety Level-III Facility for Vaccine Development and other allied research work).

Extension in the Execution Period of the following On-going PSDP Projects:

- Sino-Pak Agricultural Breeding Innovations Project for Rapid Yield Enhancement.
- Productivity Enhancement of Wheat.
- Productivity Enhancement of Rice.
- Productivity Enhancement of Sugarcane.
- Promoting Research for Productivity Enhancement in Pulses.

Preparation of Public Sector Development Program (PSDP)

- Prepared Public Sector Development Programme (PSDP) 2023-24 of 08on-going projects for forth coming Standing Committee meeting of National Assembly at M/o NFS&R.
- Prepared Project Profiles of (**08**) On-Going PSDP Projects for submission to M/o NFS&R.
- Arranged and documentation for Quarterly, Mid-Year and Annual Review of PSDP 2023-24 for submission to M/o NFS&R.
- Prepared PSDP 2023-24 and financial projection (2024-25, 2025-26, 2026-27) for the next three years of New unapproved projects for Senate Standing Committee (SSC) and National Assembly Standing Committee (NASC) and M/o NFS&R.
- Submitted budgetary proposals relating to the Public Sector Development Programme **(**PSDP) of PARC to Standing Committee of National Assembly to make recommendations for next Financial Years**.**

Revision of Ongoing PSDP Projects by CDWP/DDWP/ECNEC:

Submission of following **02** On-going revised development projects to the M/o NFS&R, the projects are considered by DDWP/CDWP.

- Sino-Pak Agricultural Breeding Innovations Project for Rapid Yield Enhancement.
- Commercialization of Potato Tissue Culture Technology in Pakistan.

Monthly Review Meeting of PSDP Projects at PARC, M/o NFS&R and M/o PD&SI:

Conducted and coordinated more than 100 monthly, quarterly and annual review meetings held at PARC, M/o NFS&R and M/o PD&SI to help update physical and financial progress of the On-going projects. Follow up on the decisions taken in the meetings for smooth execution of the projects.

Financial Outlay, Expenditure, Budget etc.

(Rs. Million)

Sr. #	Name of the Project	Approved Cost	Allocation 2023-24	Release 2023-24	Expenditure as on 30.06.2024
1.	Commercialization of Potato Tissue Culture Technology in Pakistan	218.746	25.380	25.320	25.128
2.	Productivity Enhancement of Rice	3,750.660	235.000	162.500	162.397
3.	Productivity Enhancement of Sugarcane	1,003.773	130.000	116.064	115.955
4.	Productivity Enhancement of Wheat	5,632.774	248.000	121.600	121.469
5.	Productivity Enhancement in Pulses	1,437.358	300.000	166.396	165.344
6.	Sino-Pak Agricultural Breeding innovations Project for Rapid Yield Enhancement	611.090	63.490	103.373	103.308

7.	Mainstreaming of Mountain Agricultural Research Centre (MARC) for the	288.200	65.000	56.280	56.198
8.	Pak- Korea Joint Program on Certified Seed Potato Production System.	985.067	100.530	29.150	29.150
9.	Horticulture Support Program	1,000.000	50.000	-	-
10.	Prime Minister's Initiatives for Green Revolution 2.0	5,000.000	5,000.000	-	-
	Total	**19,927.670**	**6,217.000**	**780.683**	**778.947**

Annexure I

PROPOSALS/ CONCEPT NOTES UNDER ISLAMIC DEVELOPMENT BANK (IDB)'SFOOD SECURITY RESPONSE PROGRAM (FSRP)

				(Rs.million)
Sr #	**Project Title**	**Location**	**Project Duration (Years)**	**Project Cost Estimated**
1	Food Security Through Postharvest Management and Value Addition Technologies for Fruits and Vegetables in Balochistan	Balochistan	3	2,000.000
2	Up-scaling of solar drying technologies for value addition of fruits and vegetables for export enhancement in Pakistan	Fruits and vegetables catchments of Pakistan	1.5	2,000.000
3	On-farm Research and development on Dates Processing, Value Chain and Cold Storage	Turbat, Panjgor, Khairpur and D.I Khan	3	2,000.000
4	Establishment of 3 Controlled Atmospheric Stores for annual export of Apples	Dry ports of Gilgit, Gawadar, Karachi	3	6,000.000
5	Research and value chain development of apricot in Gilgit- Baltistan to enhance export potential	Mountain Agricultural Research Centre, Gilgit/AEINARC	3	2,000.000
6	Rehabilitation of flood affected areas of the country through interventions of farm mechanisation	Flood affected areas of Pakistan	1.5	2,000.000
7	Agriculture Resilience for food security in Thar Desert of Sindh-Pakistan	PARC-Arid Zone Research Institute, Umerkot-Sindh & PARC-SARC Karachi	5	950.500
8	Converting organic Waste Materials into Value-added Bio-compost at NARC.	LRRI, NARC, Islamabad	3	19.915
9	Increasing Chickpea Production in Thal Utilizing Potential drought tolerant Rhizobacterial Biofertilizer	LRRI, NARC, Islamabad	3	11.507
10	Development of Value-added Enriched Vermicompost for Horticultural Crops and Technology Transfer to the Farmers.	NARC, Islamabad	3	15.010

11	Formulation of next generation Climate Resilient Indigenous Rhizobia-PGRP based Biofertilizer for Yield enhancement of Soyabean.	NARC, Islamabad	5	105.940
12	Increasing Crop Productivity and Improving Soil Fertility & Soil Health through Biofertilizers in Pakistan	LRRI, NARC, Islamabad	3	150.004
13	Building Drought Resilence through Integrated Land-Water-Range-Livestock Management in Fragile Econologies	Drought-prone areas of Pakistan	3	450.200
14	Enhancement of the Living Standard of Rural- Households through capacity Building in District Kech, Balochistan	Turbat District Kech.	1.5	24.564
15	Rehabilitation of flood affected small holder's livestock farmers for poverty reduction in Balochistan.	Flood affected/poorest areas of Balochistan	3	80.000
16	Sustainable Watershed Management to Development Rangelands in flood affected districts (Balochistan) Pakistan for rehabilitation & Poverty Reduction.	Flood affected districts of Balochistan	5	200.000
17	Research and development of high value horticulture crops in various ecologies of Pakistan	Federal Project Management Unit (FPMU) at NARC Islamabad	5	1,950.000
18	Cluster based value addition of high value Horticultural crops.	All over Pakistan	3	4,018.000
19	Promotion of oilseed for edible oil import substitution in Pakistan	All over Pakistan	5	500.000
20	Action Program Incorporating the Nuclear Technique Application for Area-Wide Management of Fruit flies in Fruit Orchard	Islamabad & KP Province	3	402.500
21	Pulses Area Enhancement in Balochistan	Balochistan	1.5	1,700.000
22	Promotion of Contractual Certified Pulses Seed Production	All over Pakistan	3	2,000.000
23	Promotion of Organic Pulses Production	All over Pakistan	3	1,000.000
24	Enhancement of plant genetic resources conservation facility at PGRI, NARC for food security	PGRI, NARC, Islamabad (Implementation all over Pakistan)	5	1,086.400
25	Quarantine Insect Pests Management and Phytosanitary Standards Development for Facilitating Horticultural Exports of Pakistan	PARC-SARC, Karachi (Institute of Plant Introduction & Pest Management Research Institute)	3	1,446.000
26	Field epidemiological training program for veterinarians in the field of Trans-boundary/zoonotic animal disease in Pakistan.	ASD, PARC, Islamabad	5	100.000

27	Genetic improvement program for the major carps and other high value fish species in Pakistan	All over Pakistan	5	1,561.720
28	Use of Technological Tools for Profitable Calf Fattening Operation for Meat Production	All over Pakistan	3	24.000
29	Selection and characterization of Vaccine Candidates for the development of cost effective vaccine against Lumpy Skin Disease (LSD)Virus in Cattle	All over Pakistan	3	25.000
30	DNA based identification of true breeds of cattle and buffaloes for quality traits such as milk, meat and disease resistance	All over Pakistan	5	1,200.000
31	Mapping Seasonal Marketing Routes and Direction of Trade of Vegetables in Khyber Pakhtunkhwa	KP Province	2	5.750
32	Rice Value Chain and Climate Resilient Technologies in Pakistan	NARC, Islamabad	1.5	15.000

Annexure II

Project Concept Notes (PCNs) under Public Private Partnership (PPP) Mode 2023-24

S #	Name of Project	Project Cost (Rs Mill)	Duration (Months)
1.	Commercialization of Banana Tissue Culture Technology in Pakistan	365.480	60
2.	Development and Promotion of Novel Interventions and post-harvest technologies for Fruits Crops (Dates, Banana, Mango and Citrus) In the growing catchments of Khairpur-Sukkur (Sindh)	982.000	60
3.	Introduction of New Exotic High Yielding Cultivars, Promotion and Expansion in Area under Dates Cultivation & Installation of Dates processing plant for value addition at Turbat Balochistan.	1517.300	

Agricultural Linkages Program (ALP):

The Agricultural Linkages Program (ALP), established in the year 2000, receives funding from the Agricultural Research Endowment Fund (AREF). This endowment fund is a collaborative effort between the Government of Pakistan and the Government of the United States of America through an agreement signed in February 1999.

The primary purpose of this fund is to support and promote agricultural research and development activities in alignment with Pakistan's long-term development goals. Additionally, it aims to foster long-term scientific collaboration and cooperation between Pakistan and the United States within the agricultural sector.

The management of this fund falls under the purview of the Board of Directors (BOD) of the Agricultural Linkages Program (ALP). This board oversees the allocation and utilization of the funds in various agricultural research projects. The selection of projects to be funded is done on a competitive basis within the framework of the National Agricultural Research System (NARS). The Technical Advisory Committee (TAC) is responsible for recommending projects for funding, and the final approval for funding these projects rests with the Board of Directors of the ALP.

The key activities conducted during the fiscal year 2023-24 as part of the Agricultural Linkages Program (ALP) are outlined as follows:

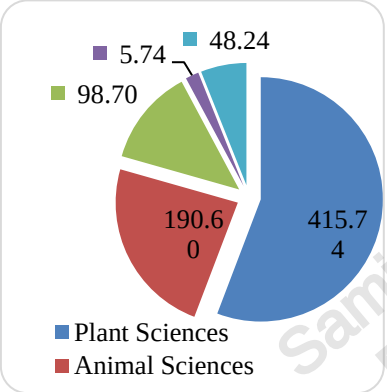


Figure 1. Region-wise on-going projects

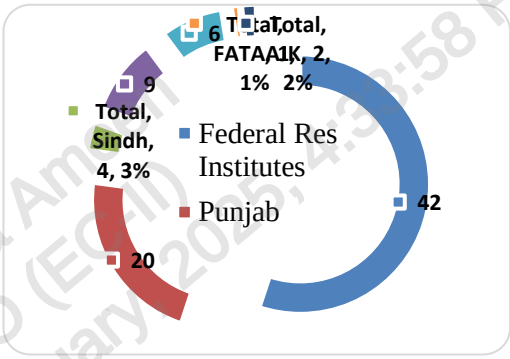


Figure 3. Discipline-wise approved budget of on-going projects

- 84projects were actively underway, benefitting from funding provided through the Agricultural Linkages Program (ALP).
- Geographical distribution data is illustrated in Figure 1, showcasing the allocation of projects across different regions.
- Figure 2provides insight into projects' distribution across various disciplines.
- The combined approved budget for these projects amounted to Rs 759.02million (Figure 3).

During the fiscal year 2023-24, a total of 20projects were brought to successful completion within the framework of the National Agricultural Research System.

- These projects were distributed across various disciplines: 10 in Plant Sciences, 04 in Animal Sciences, 03 in Agricultural Engineering, 02 in Natural Resources, and 01 in Social Sciences.
- The collective expenditure for these endeavors amounted to Rs. 135.486 million (Figure 4), drawn from the Agricultural Linkages Program (ALP).
- The ALP Secretariate ensured the seamless flow of funds by processing and releasing necessary funds in a timely manner.
- During year 2023-24, an on-site review of 11ALP funded on-going projects was conducted: 4 in Plant Sciences, 5 in Animal Sciences, 02 in Natural Resources
- ALP Secretariat, P & D Division, PARC has invited the preliminary proposals to be funded under 10th batch of ALP through advertisement.Under 10th batch of Agricultural Linkages Program, 1896 proposals were received. These proposals have been short listed by Appraisal Committees of each sector comprises of scientists/ experts representing provincial research system/ universities of each sector.

Project Monitoring & Evaluation

Research Agreement (MoU type) Projects:

Overall, 20 research agreement projects (MoU type) were ongoing during 2023-24. The MoU section of PM&E has processed and revised administrative approval of 25 projects for revision / re-appropriation of budget breakup and extended the project duration of different MoU projects as desired by the NARC/PARC scientists for smooth implementation of projects. In which, some of the major contributing donors were Australian Center for International Agriculture Research (ACIAR), Royal Botanical Garden (RBG) UK, International Atomic Energy Agency (IAEA), CIMMYT-PARC, Japan International Cooperation Agency (JICA) , Food and Agriculture Organization (FAO), Rural Development Administration (RDA), Republic of Korea through (KOPIA), South Asian Association for Regional Cooperation (SAARC), MGI Tech Singapore PTE.LTD, Joint Scientific Exchange Program of Pakistan Science Foundation (NSFC-PSF).

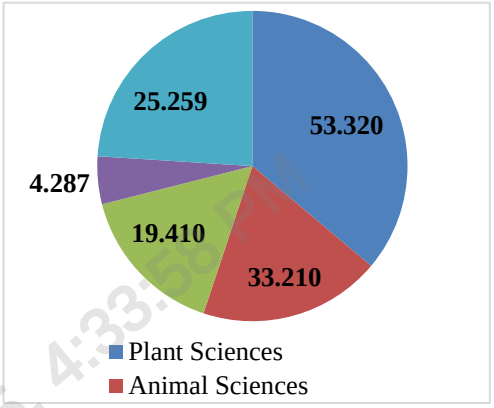


Figure 4. Discipline-wise approved budget of completed projects

MoU type projects implemented in 2023-24

Plant Science	Animal Science	Natural Resources	Social Science	Total
11	02	05	02	20

The MoU section has also processed more than 35 projects proposals and concept papers to different local and international donors like Korean International Cooperation Agency (KOPIA), NSLP (PSF), Turkish Cooperation and Coordination Agency (TIKA), Trade Development Authority of Pakistan European Union funding program, Technical corporation between Pakistan and Brazil, Malaysian Partner Institutes, competitive grant of UAE, Dutch entities, Pakistan Institute of Development Economics (PIDE) etc. The council has privilege to compete for financial assistance from the local and international donors of the world. Some of the research agreements with international organizations are underway for implementation in the future.

In-House Review of ALP Projects:
In orders to know whether the projects are on track or not to achieve the set objectives, P&DD is regularly conducting in-house of ALP projects by involving a financial/ technical expert at mid/end of the projects implementation period. During Year 2023-24, PM&E has conducted an In-House review of 43 projects of ALP from 11-07-2023 to 20-07-2023. Complete detail of projects under each division is mentioned below:

S#	Discipline	No. of Projects
1.	Plant Sciences	22
2.	Animal Sciences	10
3.	Natural resources	05
4.	Agricultural Engineering	05
5.	Social Sciences	01
Total		**43**

After successful completion of In-House review, complete review report of ALP projects has been prepared and forwarded to concerned quarter.

On-Site Evaluation of PSDP Projects:
PM&E directorate evaluated the following two PSDP projects.

- Strengthening/Up-gradation of AZRI, Umerkot, Sindh
- Productivity Enhancement of Wheat

The M&E directorate conducted on-site Monitoring & Evaluation of PSDP Project titled, "Productivity Enhancement of Wheat" on 28th May-7th June, 2024. The detailed M&E report of the said project was prepared and submitted to concerned quarter.
The M&E directorate conducted on-site monitoring & Evaluation of PSDP Project titled, "Strengthening/Up-gradation of AZRI, Umerkot, Sindh" on 26th November-30th November, 2023. The detailed M&E report of the said project was prepared and submitted on 15th December, 2023, to concerned quarter.

COORDINATION AND MONITORING

Progress for theYear 2023-24
Identification of areas/ proposals of cooperation
Provided proposals for cooperation, implementation of decisions for Joint Working Meetings, Joint Economic Cooperation meetings and Regional Cooperation meetings held under Ministry of National Food Security and Research, Economic Affairs Division, Ministry of Foreign Affairs and Board of Investment for China, Turkey, Belarus, Kazakhstan, Uzbekistan, Kingdom of Saudi Arabia, Kuwait, Qatar, Australia, USA and Russia.

Facilitation for International Projects
PARC and KOPIA, Korea
Facilitated for processing and approval of following projects:

- Improving potato production machinery in Pakistan.
- Development of Italian Ryegrass variety and expansion of new oat variety to establish village base seed enterprise through Farmer's Participatory Approach.
- Efficient Artificial Insemination Services by using Korean Holstein Sexed Semen in Cattle.
- Establishment of Seed Potato Production and Supply Centre (SPPSC) at Pakistan Agricultural Research Council, Pakistan.
- Establishment of a Smart Agricultural Farm for Vegetable Production at NARC, Islamabad.
- Establishment of Korean Holstein Breeding Stock and Development of a Composite Dairy Cattle Breed.

PARC and CABI
Facilitated in signing of Plantwiseplus Work and Funding Contract between PARC and CABI

Facilitation in organizing international meetings
Facilitated in Holding following meetings with Foreign and National Delegates:

- Pakistan – Turkmenistan Joint Working Group meeting
- Meeting of Federal Minister, NFS&R with Australian Ambassador
- Meeting of Federal Minister, NFS&R with UN Resident Coordinator

Holding of PARC's Membership in international organizations:
Renewed the membership of CABI and Centre for Sustainable Agricultural Mechanization (CSAM)

Visa Processing Facilitation:
PARC facilitated the visa processing of 18 foreign participants of Workshops/Seminars & Internationally Recruited Staff (IRS) of agricultural research organizations, posted in Pakistan.

MOUs/Agreements
Six (06) MOUs/ Agreements with international organizations and 08 national level MOUs/Agreements/LoIs have been signed with Universities/ Agri-tech companies/ NGOs/Public-Private Sectors and Public sector organizations for development and dissemination of research technologies. Following is the detail:

International Level:

1	Plantwiseplus Work And Funding Contract Between Pakistan Agricultural Research Council (PARC) and Centre for Agriculture and Biosciences International (CABI)	27-07-2023
2	Agreement between PARC and Global Crop Diversity Trust (GCDT) Bonn Germany	02-08-2023
3	Letter of Agreement between Food and Agriculture Organization (FAO) of United Nation and PARC	13-12-2023
4	Agreement between Pakistan Agricultural Research Council (PARC) and The Ministerial Standing Committee on Scientific and Technological Cooperation of the Organization of Islamic Cooperation (COMSTECH).	04-04-2024
5	Letter of Exchanges for Juncao Cultivation Demonstration and Promotion Project	11-06-2024
6	MoU between Pakistan Agricultural Research Council (PARC) and the Chinese Academy of Agricultural Sciences	14-06-2024

National Level:

S.No	MoU between PARC & other farms	Commencing date
1.	LOI b/w PARC & WINROCK International Institute for Agriculture Development.	03-08-2023
2.	MOU b/w PARC & Association for Gender Awareness and Human Empowerment (AGAHE)	11-08-2023
3.	MOU b/w PARC & Center for Non-communicable Diseases (CNCD), Karachi	13-10-2023
4.	MOU b/w PARC & Pak One Health Alliance (POHA)	06-11-2023
5.	MOU b/w PARC &Riphah College of Veterinary Sciences (RVCetS) Lahore. RIPHAH	02-02-2024
6.	MoU between PARC & KAFALAH Foundation	26-02-2024
7.	MoU between PARC & Holstein Research Management Pvt ltd Pakistan (HRM)	07-03-2024
8.	MoU between PARC & Green Perfect Plant (GPP)	18-04-2024

Human Resource Development

Training	Program	No. of nominees
Foreign long term	MS/ M.Phil/Diploma	0
	Ph.D	3
	Post Doc.	2
Local long term	MS/ M.Phil/Diploma	10
	Ph.D	7
Foreign short term		59
Visits		72
Local short term		23

Promotion of Higher Education Promotion in Agriculture

PARC Institute of Advanced Studies in Agriculture (PIASA)

In view to even increasing skills and expertise gap in the advanced agricultural sciences and to capitalize on its rich knowledge base and infrastructure, PARC established PARC Institute of Advance Studies in Agricultural (PIASA) in 2008, to embark upon a unique postgraduate academic program at the campus of NARC.

PIASA has been affiliated with University of Agriculture, Peshawar since 2010 to 2017 and since 2012, with Quaid-i-Azam University, Islamabad. As to ensure excellence in education as well as research in order to actively contribute towards human resource development in fields of agriculture, livestock and other allied disciplines for more than a decade. PIASA has been offering MPhil and Ph.D programs in the following disciplines:

- Animal Genomics & Biotechnology (AGB)
- Applied Economic (AE)
- Plant & Environmental Protection (PEP)
- Plant Genomics & Biotechnology (PGB)
- Natural Resource Management (NRM)

During the year, 3 Ph.D students of PIASA successfully completed their degree in their respective fields. Currently, 17 Ph.D students are enrolled and their relevant dealings are being catered through coordination with their host universities. As the admission process was halted due to HEC policy limitation, various meetings were held with Chairman HEC and Vice Chancellor QAU for resumption of academic process at PIASA. HEC has allowed PIASA to resume its academic programs with Quaid-i-Azam University Islamabad, which is in process.

AGRICULTURAL ENGINEERING

Rice residue management machinery for wheat sowing

Introduction

Farm mechanisation is an important farm input, which enhances the efficiency of all other inputs. Wheat crop is a highly mechanised as compared to other crops. Rice-wheat cropping area in Pakistan is 2.2 mha, out of which 1.25 mha is in the Punjab province. In the Central Punjab, rice crop is mainly harvested using combine harvesters. Handling of combine-harvested rice residue is a big issue, which is frequently bunt in the field by farmers. This gives rise to environmental pollution and loss of soil nutrients is also the major consequence of straw burning.

Progress and salient achievements

For sowing of wheat in combine harvested paddy fields is a challenge due to handling of heavy rice residue to avoid delay in crop sowing. Agricultural Engineering Institute (AEI) has developed rice residue management technologies called as Pak Seeder and Combine Seeder that can plant wheat crop directly in combine-harvested paddy straw. These technologies not only improve soil biological and physical health, but also

increase wheat and rice yield. These resource conservation technologies can enhance crop yield up to 10%, reduce nutrients loss of the soil and save environment form smoke pollution. These technologies will help reduce the SMOG problem in the country. During the year 2020-23, wheat planting trials were carried out at different locations in the Punjab to see the performance of the machine (Figure 1). Results were compared with the conventional wheat sowing practices (Table 1). Field seminars and demonstrations were also arranged to provide awareness and promote these technologies among farming community.

Table 1. Wheat yield data (3-years' comparison)

Sr. No.	Location	Combine Seeder (mnd/a)	Pak Seeder (mnd/a)	Control (mnd/a)
1.	Gujranwala	49.45	46.82	42.70
2.	Sialkot	51.50	46.66	41.35
3.	Sargodha	46.80	46.96	40.25
4.	Sheikhupura	38.46	35.04	33.95
5.	Sheikhupura	47.12	46.89	42.56
6.	Gujrat	37.39	38.62	33.50
	Average (Mnd/a)	**45.12**	**43.49**	**39.05**
	Average (kg/ha)	**4,458**	**4,298**	**3,858**






Figure 1. Field trials of Combine Seeder and demonstration to farmers.

Promotion of rice production machinery

Introduction

Pakistan is the world's 10th largest producer of rice. Pakistan's exports make up more than 8% of world's total rice trade. It is an important crop in the agriculture economy of the country. In Pakistan, rice is grown manually by sowing rice seedlings and then transplanted manually in the puddled soil using labour force. The plant population achieved by manual transplanting is around 35,000-40,000 plants per acre while recommended plant population is around 80,000-85,000 plants per acre. This difference is plant population results in low productivity of rice crop in Pakistan.

Progress and Salient Achievements

Agricultural Engineering Institute, NARC provided technical assistance to farmers / service providers for rice nursery raising and mechanical transplanting. The calibration of rice nursery raising and tray filling was demonstrated to the farmers in Gujranwala, Sheikhupura, Sialkot and Hafizabad field areas for efficient use and promotion of the technology. Rice transplanters were also tested to compare the results of new and reconditioned / used rice transplanters. Data for the performance evaluation of new and used rice transplanters was recorded from Gujranwala, Sialkot and Hafizabad field areas. Based on the results of the machinery, recommendations will be given to farmers for using the appropriate machinery to maximize their yield and profit.

Two awareness field seminar on "Rice planting and harvesting machinery" was organized in Norowal and Hafizabad. Around 300 farmers, manufacturers, service providers like Meskay & Femtee Trading Company, Gujranwala, BMITCO Agro Services, Sialkot, Chairman Sons Zarai Corporation Gujranwala, extension and agricultural officers and policy makers attended these seminars. Director General, Agricultural Engineering Division, PARC was the Chief Guest of the events. Speakers from the Punjab and Federal Government trained the participants about using rice specific machinery to enhance rice productivity and reduce losses.

Training to about 250 farmers was provided to farmers / service providers about the key parameters to be understood and noted while using rice machinery. For example, during rice harvesting, the farmers were suggested to check rice straw behind the machinery and check the extent of grain losses in the straw. If there are more losses in the straw, he should convey this to the operator of combine harvester. To control these shattering losses, the operator should reduce the travel speed and increase engine speed.

Figure 2: Glimpses of field activities to promote rice mechanization.

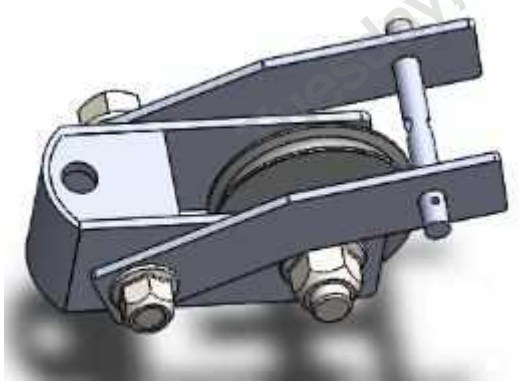
Design, Development and Adaptation of an Olive Harvester

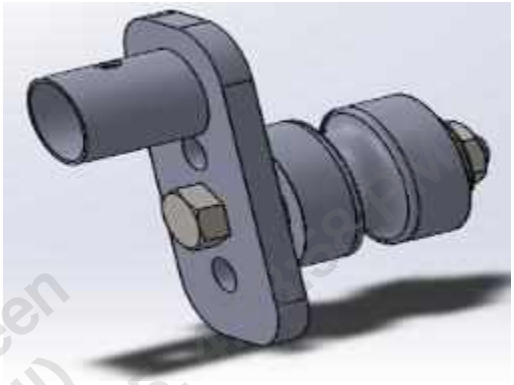
Introduction

Olive (Olea europaea L.) is an important species of evergreen trees and its fruit produces premium quality oil. Olive oil is very beneficial for health, which comes from olive fruit and contains monounsaturated fatty acids. Different olive varieties have been cultivated in the arid and semi-arid regions of the country, such as Chakwal, Fateh Jang, Zhob, Loralai, Killa Saifullah, Barkhan, North Waziristan, Bajaur Agency, Mohmand Agency, Kurram Agency, Hangu, Khyber Agency, South Waziristan, Malakand, Charsadda and Haripur. Olive fruit is mostly cultivated in the Punjab, Khyber Pakhtunkhwa and Baluchistan provinces. In the Punjab, it is abundantly grown in the *Pothohar* region and its fruit is mostly harvested manually. This method is time-consuming and labour-intensive, also it results in delayed harvesting and loss in quality and weight that will ultimately increase production costs and decrease profit.

Progress and Salient Achievements

A tractor-operated olive harvesting machine was designed and fabricated at Agricultural Engineering Institute (AEI), NARC, and Islamabad with the collaboration of Department, of Engineering and Technology, Pir Mehr Ali Shah University of Arid Agriculture, Rawalpindi. The newly developed machine was tested in the Bari Zaitoon-I cultivar for its performance evaluation. It was evaluated at different PTO speeds, stroke lengths, and vertical clamp positions on the tree to find the harvested and leftover fruit (%) and field capacity (trees/h) of the machine. Data collected was statistically analyzed by using *"Staistix 8.1"* software at a 5% level of probability. The best results of 92.4% harvested fruit, 7.6% leftover fruit and 23.6 trees/h field capacity were obtained at 300 rpm PTO speed, 10cm stroke length and 1-m clamp position on the tree trunk from the ground. The machine has proven invaluable efficiently replacing expensive manual harvesting operations with timely and economical alternative. More research should be carried out in future to develop improved versions of this olive harvester.





Design, fabrication and testing of indigenous olive harvester

Design and Development of a Groundnut Precision Planter

Introduction

Groundnut (Arachis hypogaea L.), commonly known as peanut, is a vital leguminous crop grown for its edible seeds and oil. Groundnut is rich in proteins, healthy fats, and essential vitamins, making it an important dietary component and a valuable crop for both domestic consumption and export. In Pakistan, groundnut is cultivated predominantly in the arid and semi-arid regions, where it thrives in the warm climate and sandy soils. The cultivation of groundnut is crucial for the local economy as it supports rural livelihoods and provides a source of income for many farmers. However, the sowing of groundnuts is often carried out manually, which is labor-intensive and time-consuming. This method can lead to inconsistent planting depth and spacing, potentially affecting crop yields and overall productivity. The development of a precision planter for groundnut could significantly improve sowing efficiency, ensure optimal planting conditions, and enhance both the quality and quantity of the harvest, ultimately increasing profitability for groundnut growers in Pakistan.

Progress and Salient Achievements

Production drawings of different seed metering units for groundnut precision planter were prepared using SolidWorks software. Horizontal and vertical seed metering units were fabricated at AEI, workshop. Both systems were lab tested for their performance evaluation. Developmental and modification work is in process. Visited different agricultural machinery manufacturers in Daska, Gujranwala and Lahore regarding the development of precision parts like seed metering units for groundnut precision planter. Detailed discussions were made with the manufacturers for the fabrication of the most suitable metering units of groundnut with die-casting, injection molding or CNC machining. Visited their manufacturing facility and inspected already development metering units for multi-crops using die-casting, injection molding and CNC machining.

On-farm mechanized postharvest processing and value addition technologies for fruits in Gilgit Baltistan and KPK

Introduction

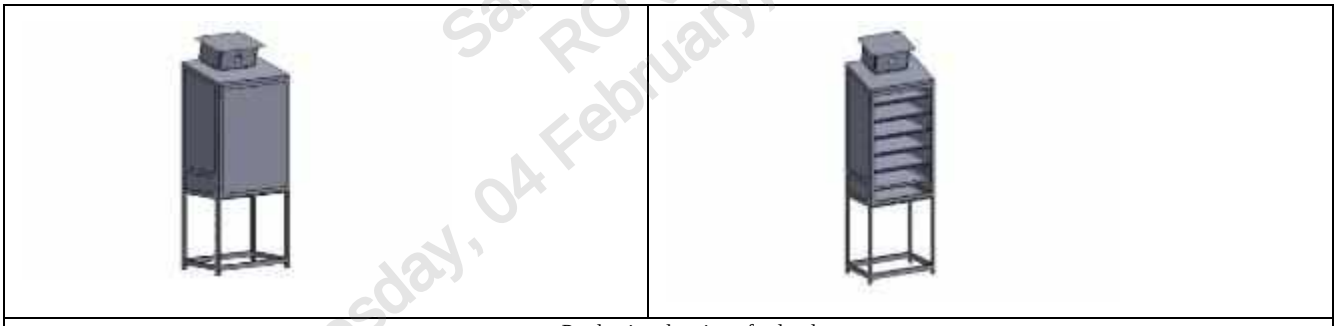
Fruits play a crucial role in the agriculture and economy of Khyber Pakhtunkhwa (KPK) and Gilgit-Baltistan, where diverse climatic conditions and topographical variations support a wide range of fruit crops. In these regions, fruits such as apples, pears, peaches, apricots, and plums are cultivated, providing essential nutrition and contributing significantly to the livelihoods of local farmers. However, the perishable nature of fruits presents challenges in storage and preservation, leading to high post-harvest losses due to spoilage and degradation.

To address these issues, the development of desiccant-assisted solar dryers offers a promising solution. Unlike conventional drying methods, which may be affected by unpredictable weather conditions, desiccant-assisted solar dryers leverage solar energy combined with desiccant materials to efficiently remove moisture from fruits. This technology provides a controlled drying environment that enhances the preservation of fruit

quality and extends shelf life. In KPK and Gilgit-Baltistan, where the climate can be variable and traditional drying methods may be insufficient, desiccant-assisted solar dryers can significantly reduce post-harvest losses and improve the economic viability of fruit production. Implementing this advanced drying technology could not only increase the profitability for local fruit growers but also contribute to the development of the agricultural sector in these regions by ensuring better quality and availability of dried fruit products.

Progress and Salient Achievements

Detailed design drawings were prepared using SolidWorks software, allowing for precise visualization and refinement of the dryer's components and overall structure. Additionally, a crucial step in advancing the project involved visiting a private industry to gain valuable technical input and explore opportunities for future collaboration. This engagement with industry experts provided insightful feedback on design improvements and operational efficiency, further enhancing the project's feasibility and implementation. These efforts collectively contribute to the successful advancement of the desiccant-assisted solar dryer, positioning it as a promising solution for improving fruit preservation in Khyber Pakhtunkhwa and Gilgit-Baltistan.



Production drawing of solar dryer

List of new initiatives of AED to promote agricultural mechanization

- Development and adaptation of a solar powered multi-crop walk-behind mechanical weeder
- Development and adaptation of chili harvesting technology for small farmers
- Design optimization and field valuation of sugarcane seedlings precision transplanter and bud chip cutting machine
- Design, development and performance evaluation of paper-pot strip seedling precision transplanter for vegetables
- Design, Simulation and testing of drone for precision Agriculture
- Development of intelligent multi-fruit grading machine and smart application
- Climate smart mechanization technologies for sustainable agriculture
- Adaptation and commercialization of small farm machinery for small landholders

List of Publications

1. Md-Tahir, H, Mahmood, H. S, Xia, J, Zhang, J, Khaliq, A, Ali, M. Advancing Agricultural Mechanization and Arable Land Management for Climate Resilient and Sustainable Agro-Food System. 2024. Proceedings of Emerging Scientist - Season III. Asian Council of Science Editors.
2. Khan, A.A., Haq.U.Z., Islam.A.M., Saad. A., Raza.M.S., Ali. I., Sheraz.K., Usman.M., Ali.M.M., Ali.M., 2023. Prospectus and Scope of Olive Mechanization: A Review. Zoo Botanica.01 (2) 79-93. ISSN 3007-2050 (E) 3007-2042 (P).
3. Munir, Z., Román, F., Niazi, B. M. K., Mahmood, N., Munir, A., & Hensel, O. (2023). Parametric analysis for energetic optimisation of a solar shell-and-tube latent heat storage unit for agricultural applications. Applied Thermal Engineering, 233, 121029. https://doi.org/10.1016/j.applthermaleng.2023.121029.

13. PAKISTAN CENTRAL COTTON COMMITTEE (PCCC)

1. **Overview of the PCCC**

Pakistan Central Cotton Committee is a body corporate established under cotton cess act 1923 with an objective "improvement *and development of the growing marketing and manufacturer of cotton*". The Committee established its subordinate facilitates in the four provinces. PCCC relies solely from the Cess income, levied at Rs.50 per bale consumed in the country. PCCC played a leading role in cotton research & development at country level in varietal development, cotton policy making at national level, liaison with provincial government for cotton improvement programs, and effectively coordinated with international bodies.

PCCC's Organogram

2. Directorate of Agricultural Research

Directorate of Agricultural Research (DAR) is one of the largest Directorate of the Pakistan Central Cotton Committee (PCCC) and charged with the task of coordinating the whole cotton R&D system at national level. Its mandate includes the development of crop agricultural-research policy, planning, program-of-research work, implementation, coordination, monitoring and evaluation, reviewing and reporting the progress of various activities, projects, programmes of various institutes and stations of PCCC. Directorate of Agricultural Research is also responsible for high-level coordination with public and private sector stakeholders at federal and provincial levels and with ever expending cotton private sector as well. The key responsibilities of the Directorate of Agricultural Research include the following;

- **Meetings of Agricultural Research Sub-Committee (ARSC)**: The Directorate of Agricultural Research organizes each year the meeting of the ARSC with the main objectives of cotton research policy, planning and their implementation at national level. This committee also reviews the status of implementation of the suggestions and recommendations provided in their sessions and their proper follow up in letter and spirit.The PCCC's cotton research system comprises of two research institutes and five research stations working under the DAR's headquarter based at Multan since November

2014.

- **Cotton Research Plan and Progress:** Through Agricultural Research Sub-Committee (ARSC), DAR accomplishes the assignment of development of Research Program of Work for proceeding crop year and also developing the Annual Summary Progress Report for the past year.

- **National Coordinated Varietal Trials (NCVTs):** National Coordinated Varietal trials are conducted by Directorate of Agricultural Research, PCCC with the objective of testing promising breeding material/strains developed by various cotton breeders of Federal and Provincial institutes as well as private sector seed companies for adaptability under various agro-environmental conditions of different ecological zones under the supervision of Director-Research. After comprehensive coordinated testing the lines meeting the field, seed and lab standards are recommended for general cultivation in the country. During the cotton crop year 2023-24, Directorate of Agricultural Research evaluated 95 new cotton strains of various research organizations and private sector companies.

- **National Technology Testing Trials:** New technologies with promising impacts on cotton production, developed by multi-national and national sector are also tested by the Directorate under prescribed SOPs.

- **National Chemical Testing Trials:** Various new candidate chemistries in pesticides, herbicides and fertilizers, etc. are tested and on the basis of testing results these candidate pesticides are registered by Federal Department of Plant protection (DPP).
- **Cotton Breeders Tour:** The Directorate is supposed to conduct a Cotton Breeders Tour every year where the main or second-line cotton breeders are given an opportunity to evaluate the performance of their new lines under various environmental conditions of the cotton belt. Breeders from both public private sectors participate in it.

- **Cotton Travelling Seminar:** The Directorate organizes cotton travelling seminar each year with the main objective to impart in-service like training/visit to all cotton R&D system of the country in a highly coordinated way.

- **Strengthen of Cotton Breeding Programs of private sector**: Special coordinated efforts are made by the DAR on regular and sustained basis to strengthen the breeding, varietal-development, early generation system of seed and Commercial seed production system of this rising sector.

- **Cotton R&D Projects/Programs**: DAR is also responsible for developing and running various small, medium and large-scale cotton R&D and extension programs and projects funded by government and international donors.

- **Linkages with academia**: DAR works with almost all Agricultural universities/faculties for external thesis cotton research; external thesis-exam, working in Board of studies and various committees of the Universities with the objective to strengthen education in cotton.

- **Publications**: DAR deals with all sorts of publications for cotton. Main publication is the Annual Online Research Journal titled "International Journal for Cotton Research and Technology (IJCRT) available at www.ijcrt.pk.

These research institutes and stations of PCCC are focused on the following main aspects of the Cotton.

- Study of cotton plant from botanical, genetical, physiological, production, entomological, pathological and other relevant facets in a coordinated manner.

- To develop the cost-effective production technology.
- To undertake the research work of national importance and handle problems of inter-regional nature.
- Advance knowledge of cotton plant responses to environment with a view to better cope with adverse impacts in the changing climatic scenario.
- Provide education and training on cotton production technology to the Agricultural Research, Extension, teaching staff and other stakeholders.
- Identify problems of cotton growers and advocate remedial measures.
- Promote mechanization in cotton production system.
- Transfer production technology to the cotton growers.
- Educate and motivate cotton growers and monitor research outcomes.
- Provide technical support to the Pakistan Central Cotton Committee in coordinating and developing a national program for cotton research and development.
- Training manpower across the country and other cotton growing countries on Cotton Research and Development.
- Facilitation and research guidance to students at graduate and higher level degree courses.
- Coordinate with the International cotton Researchers Association through ICRA Secretariat Multan.
- Economic studies and Marketing Investigations.

This research of PCCC resulted in the development of 58 cotton varieties which are given below**.**

Varieties developed by PCCC from 1985 to 2024 along with their fiber characteristics.

S No.	Variety	Yearof release	Lint %	Staple length (mm)	Mic(µg inch^{-1})	Strength (tppsi/g tex^{-1})
1	SKD-10/19	1984	40.6	15.5	10.1	80.0
1	SLH-41	1985	36.0	26.4	4.4	95.8
2	CIM-70	1986	31.5	29.0	4.2	92.5
3	CIM-109	1990	35.3	27.2	4.7	92.0
4	CIM-240	1992	36.5	27.5	4.4	93.7
5	CRIS-9	1992	34.5	26.5	-	97.0
6	BH-36	1992	38.7	28.0	4.3	100.3
7	CIM-1100	1996	38.0	29.0	3.9	94.0
8	CIM-448	1996	38.0	28.5	4.5	93.8
9	CIM-443	1998	36.7	27.6	4.9	96.0
10	CIM-446	1998	36.2	27.0	4.7	97.4
11	CIM-482	2000	39.2	28.5	4.5	98.0
12	BH-118	2000	38.7	27.6	4.6	96.2
13	CRIS-5A	2001	35.5	26.8	-	97.5
14	CIM-473	2002	39.7	29.6	4.3	95.2
15	CIM-499	2003	40.2	29.6	4.4	97.3
16	CIM-707	2004	38.1	32.2	4.2	97.5
17	CIM-506	2004	38.5	28.7	4.5	98.9
18	CIM-496	2005	41.1	29.7	4.6	93.5
19	CRIS-134	2004	36.5	27.5	-	97.5
20	CRIS-467	2004	37.0	27.5	4.6	97.2
21	CIM-534	2006	40.1	29.0	4.5	97.2

22	CRIS-121	2006	36.8	27.5	4.9	98.5
23	CIM-554	2009	41.5	28.5	4.7	96.8
24	CRIS-342	2010	38.5	28.4	4.3	95.5
25	CIM-573	2012	39.3	31.6	4.6	90.2
26	CIM-598	2012	41.8	29.0	4.3	94.8
27	BH-167	2012	41.1	29.1	4.7	92.7
28	SLH-317	2012	38.0	29.8	4.4	96.7
29	CIM-595	2013	39.5	29.0	4.7	97.5
30	CIM-599	2013	41.6	28.9	4.6	95.0
31	CIM-602	2013	40.3	29.1	4.2	94.8
32	CIM-608	2013	41.1	28.5	4.6	93.9
33	CRIS-129	2014	38.5	28.5	-	98.5
34	CYTO-124	2016	42.6	30.3	4.4	92.4
35	CIM-620	2016	40.2	28.9	4.6	93.0
36	SLH-8	2016	39.0	29.0	4.6	-
37	CYTO-178	2016	40.8	29.0	4.3	105.2
38	CIM-600	2017	40.3	29.0	4.7	94.8
39	CYTO-177	2017	40.0	29.0	4.3	99.9
40	CYTO-179	2017	40.2	28.2	4.2	107.6
41	CIM-598	2017	40.0	29.5	4.6	96.0
42	CRIS-508	2017	40.5	28.7	4.7	99.4
43	CRIS-510	2017	39.0	28.2	4.0	92.8
44	CRIS-533	2017	40.5	28.8	4.0	97.8
45	CIM-610	2018	40.2	28.8	4.3	101.9
46	CIM-632	2018	41.6	28.8	4.3	100.4
47	CRIS-585	2020	39.6	28.8	4.3	-
48	CRIS-543	2020	40.5	28.3	4.3	-
49	CIM-678	2021	40.0	28.6	4.0	29.9
50	CIM-785	2021	40.0	29.0	4.6	31.2
51	CYTO-533	2021	41.0	28.1	4.2	-
52	CYTO-535	2021	41.2	28.8	4.1	28.8
53	CYTO-226	2021	41.0	30.5	4.6	28.5
54	BH-221	2021	38.0	29.1	4.6	-
55	CIM-343	2023	40.0	28.2	4.3	33.5
56	CIM-537	2023	41.0	28.3	3.8	31.5
57	Cyto-511	2023	38.5	28.8	4.1	29.2
58	CIM-775	2023	39.2	28.4	4.2	29.3

3. Central Cotton Research Institute, Multan

Central Cotton Research Institute (CCRI), Multan, the prime research facility of Pakistan Central Cotton Committee (PCCC) was established in 1970. By the grace of Allah, the Institute has completed 53rd year after its establishment. The Institute is equipped with different research disciplines including Agronomy, Plant Breeding & Genetics, Cytogenetics, Entomology, Plant Pathology, Physiology/Chemistry, Fibre Technology, Transfer of Technology and Statistics. The research work has been focused on the following main aspects:

1. Study cotton plant from botanical, genetical, production, physiological, chemical, entomological, pathological and other relevant aspects in a coordinated manner.
2. Undertake research work of national importance and handle problems of inter-regional nature.
3. To develop cost-effective cotton production technology.
4. Advanced knowledge of the cotton plant responses to environment with a view to better cope with adverse impacts in the changing climate scenario.
5. Provide education and training on cotton production technology to the agriculture research, extension, teaching staff and other stakeholders.
6. Identify problems of cotton growers and advocate remedial measures.
7. Promote mechanization in cotton production system.
8. Transfer production technology to the cotton growers.
9. Educate and motivate cotton growers and monitor research outcomes.
10. Provide technical support to the Pakistan Central Cotton Committee in coordinating and developing a national program for cotton research.
11. Training manpower across the country and other cotton growing countries on "cotton research and development".
12. Facilitation and research guidance to students at graduate and higher level degree courses.

The Institute has so far developed 38 elite cotton varieties since its inception. Developments have been made in earliness, heat tolerance, drought tolerance, disease resistance and fiber quality traits. CCRI, Multan pioneered in developing cotton leaf curl virus (CLCuV) resistant varieties when the country suffered a huge loss in cotton production during 1993-94. In addition to the varietal development, the scientists of the Institute developed water-saving planting techniques, pest scouting models and Economic Threshold Levels (ETLs) for various pests, evaluate nutritional requirement of cotton varieties, and addressing soil health issues. Since its establishment, CCRI, Multan has made tremendous progress in cotton R&D in various aspects of cotton crop.

i) Research Experiments

The research experiments conducted during 2023-24 by various sections are as follows:

Agronomy Section

Sr.#	Title of Study/Experiment
1	Effect of time of sowing on productivity of advanced genotypes
2	Effect of time of sowing on productivity of transgenic genotypes
3	Effect of planting geometry on productivity of transgenic genotypes
4	Impact of various levels of nitrogen in combination with potassium on yield performance of newly developed genotypes
5	Yield response to residues management and tillage systems in cotton-wheat cropping system
6	Optimizing the time of mepiquat chloride application in cotton at various planting geometries
7	Agro-economic feasibility for cotton-based intercropping system
8	Screening of pre-emergence weedicides in cotton

Plant Breeding & Genetics Section

Sr.#	Title of Study/Experiment
1	Testing of New Strains Developed at CCRI, Multan
2	Micro Varietal Trials
3	Standards Varietal Trials
4	Testing of Promising Strains of Cotton Breeders under NCVT Program
5	Development of new Breeding materials for variety evolution
6	F_2 Generation Block
7	Spot Examination trial at Punjab Seed Corporation Farm, Khanewal
8	Early Generation Seed (*Bt.* and Non *Bt.*)
9	Pre-basic & Basic Seed Production
10	Fresh crosses
11	Maintenance of genetic stock

12	Study of Gene Flow/ out crossing
13	Performance of exotic Vs local cotton varieties under the agro-climatic condition of Multan
14	Ratooning and screening of ICARDA Cotton germplasm for development of CLCuV resistance/ tolerance strains.
15	Study of phenotypic diversity

Cytogenetics Section

Sr.#	Title of Study/Experiment
1	Collection and maintenanceof *Gossypium* germplasm
2	Interspecific hybridization
3	Colchiploidy
4	Search for *Bt*. homozygous resistance against CLCuD under field conditions
5	Testing of Cyto-material in Micro-Varietal Trials
6	Testing of Cyto-material in varietal trial
7	Mapping population development for fiber quality
8	Early generation system
9	Evaluation of new strain under varied ecological zones
10	Biotechnological studies

Entomology Section

Sr.#	Title of Study/Experiment
1	Studies on Pink bollworm
2	Monitoring of population dynamics of different lepidopterous pests
3	National Coordinated Varietal Trials
4	Impact of cotton sowing period on sucking pests, natural enemies' population tendency
5	Incidence of arthropods abundance on light and normal green cotton leaves in relation to commercial aspect
6	Cotton pests management through augmentative releases of *Rhynocorismarginatus*
7	Monitoring of insecticide resistance
8	Screening of new and commercially available insecticides
9	Studying effect of Methyl Jasmonate (plant volatile) on cotton pests and their predators

Plant Pathology Section

Sr.#	Title of Study/Experiment
1	Monitoring and collection of cotton diseases in the cotton belt of Punjab
2	Evaluation of breeding material against CLCuD.
3	Epidemiological studies of CLCuD
4	Evaluation of advanced strains of cotton in NCVT against cotton diseases
5	Management of cotton diseases

Plant Physiology/Chemistry Section

Sr.#	Title of Study/Experiment
1	Studies on genotype - environment interactions
2	Soil health and plant nutrition
3	Plant-water relationships
4	Seed physiology

Transfer of Technology Section

Sr.#	Title of Study/Experiment
1	Integrated multi-media publicity campaign
2	TeleCotton SMS Service

Fibre Technology Section

Sr.#	Title of Study/Experiment
1	Testing of lint samples
2	Testing of commercial Samples
3	Enhancing Nutrient-Use-Efficiency (NUE) by synchronizing application rate and methods
4	Effect of different Intercrops in cotton on fibre characteristics
5	Quality survey of lint collected from ginning factories
6	ICA-Bremen Cotton Round Test Program, Faser Institute, Germany
7	Collaborative study with academia, ginning, spinning and other cotton stakeholders

ii) Approval of Cotton Varieties

The Punjab Seed Council (PSC) accorded approval of 2 cotton varieties (*Bt*.CIM-775 and Cyto-511) for commercial cultivation.

***Bt*.CIM-775**

Lint %age: 42.3

Staple Length: 28.0

Micronaire: 4.8

Strength: 28.6

***Bt*.Cyto-511**

Lint %age: 38.0

Staple Length: 28.0

Micronaire: 4.5

Strength: 29.95

The varieties have cleared all their regional and adaptability trials. All the varieties have excellent fibre quality traits with high yield potential. The approval and cultivation of these varieties will pave the way for enhancing cotton productivity in the country.

iii) Biological Control with Beneficial Insects

a) Assissin Bug

Assassin Bug technically known *Rhynocorismarginatus* was released in Multan and its surroundings by the Entomology Section of CCRI, Multan on cotton crop. Farmers were advised not to eliminate this insect considering it harmful. It is a beneficial insect so must not be wrongly eliminated as it appears like red cotton bug which is a serious pest on cotton crop.

i) Egg-laying by *R. marginatus* ii) *R. marginatus* feeding on Armyworm larva

b) Spiders

Spiders are not insects for technical reasons, but play an important role as biocontrol agents predating successfully on various insect pests of crops especially cotton. Among the spider diversity including other naturally occurring predatory fauna at CCRI, Multan farm, the most dominating is Orb-web spider group, particularly the spider *Neoscona theisi*. Spider are comparatively more capable to resist adverse ecological conditions than other bioagents (Pak. Cottongrower, Jul-Sep, 2022). Whitefly, jassid, moths,

boll weevils and flies were found entangled in its webs.

Farmers are informed that spiders do not cause damage to the cotton crop, rather they are beneficial by making the harmful insects their food. Avoid passing through its web, so that the spiders and their eggs in the crop are safe.

iv) Newly Reported Cotton Pest

a) Painted Bug

A new sucking insect Painted Bug have been observed on the cotton crop, which is usually a pest that damages vegetables. Nymphs and the adults suck cell sap from leaves and the developing plant parts. The nymphs and adult bugs excrete resineous material. Studies regarding its host range and damage intensity etc need to be carried out to further identify its significance in pests category.

b) Lace Bug

Lace Bug (*Urentiushystricellus*) family Tingidae, (confirmed by the Entomology Section, Central Cotton Research Institute, Multan), is being observed. This insect causes serious damage to the cotton leaves by sucking the sap. Although its presence is mentioned on the lower part of the leaves in the literature, but we have seen its attack on the upper part of the leaf as well, where it gets its food. The affected part appears as spots. Later this part turns yellow and dries up. Small piles of waste faecal are also present in the affected area. Spraying and other measures taken to destroy other cotton pests also control the lace bug very well. Therefore, farmers do not need to worry much for its attack.

Feeding on upper part of leaf

No attack on lower part of leaf

Adults and faecal residue on leaf

v) Cotton Biotechnology

The Cotton Biotechnology Lab. has been established at CCRI, Multan to develop local cultivars with export-quality lint as well as resistant to drought stress and bollworms. Apart from lab. work, the impact of abiotic & biotic stresses on cotton fiber quality is also studied. The lab. is equipped with basic instruments that are necessary to carry out genetic transformation and GMO testing of cotton genotypes. The genes of different traits synthetically synthesized for transformation in local cotton cultivars as detailed below:

Name of Gene	Function
Cry2A	Pink Bollworm Resistance
DREB2	Abiotic Stresses including Drought Tolerance
MYB (Family Gene)	Fibre Improvement

Genetic transformation of Cry2A, DREB2, and Gt-Gene for bollworm, abiotic stress drought and glyphosate resistance genes, respectively into commercial cultivars, have been accomplished and are presently under evaluation for gene stability and other molecular analysis to develop resistance against bollworms, abiotic stress and herbicides.

vi) Cold Room for Storage of Cotton Germplasm

The Institute has developed sub-zero cotton seed storage facility for long-term storage that comprises more than 6,143 accessions (Local: 1,290 and Exotic: 4,853) that have been collected from various national and international resources. The seed of different varieties is preserved on short (25 years), medium-term (50 years) and long term (100 years) basis and is in hand to be used by researchers to develop new varieties. The germplasm is shared with various local / international organizations / universities for breeding purposes.

vii) Activities under Cotton Project "Better Cotton Initiative (BCI) for Sustainable Cotton Production in Pakistan"

The project "Better Cotton Initiative (BCI) for Sustainable Cotton Production in Pakistan" is in operation in Punjab and Sindh provinces for the management of cotton in line with the BCI principles. The project objectives include the use of quality seed of approved varieties, adoption and promotion of Better Management Practices (BMPs), implementation of Integrated Pest Management (IPM) practices, including optimized use of pesticides, fertilizers, irrigation water, soil health improvement, adoption of descent work practices by farm and farmers and promotion of Clean Cotton production and picking practices through training of women pickers. The project aims to reduce the cost of production by up to 20-25% by ensuring the sustainability of production resources (soil, water and environment).

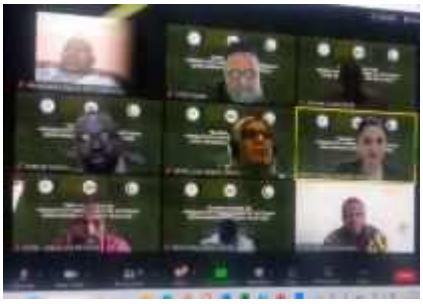
The project activities were carried out partially due to limited release of funds. The major activities included registration of 48,319 farmers for BCI practices covering an area of 157,030 acres, 10 farmers training programs, 08 Better Cotton Knowledge Network (BKN) meetings with BCI officials and 24 monthly meetings with BCI staff during the period. The periodic progress of the BCI project is given below:

Activity	2019-20	2020-21	2022-23	Total
Farmers Registered	14,799	8,932	24,588	48,319
Area Covered (Acres)	25,565	7,116	124,350	157,030

In addition, technical material in Urdu and Sindhi languages were also printed for distribution among the farmers during training programs conducted at CCRI, Multan and in the project areas.

viii) OIC Cotton Capacity Building Program (COTTON-CAB)

Central Cotton Research Institute Multan in collaboration with SESRIC Turkey organized training course on "Productivity Enhancement of Cotton by Using Modern Agronomic Practices" under the OIC Cotton Capacity Building Programme (COTTON-CAB) for the benefit of National Cotton Institutions in OIC African Member Countries from Feb 14-16, 2023. The training course was also coordinated by Islamic Development (IsDB), Food & Agriculture Organization (FAO) of the United Nations and African Association. 37 participants from African countries including Nigeria, Togo, Uganda, Cote-D'Ivoir, Mozambique, Namibia, and from Turkey & Azerbaijan attended the training program. 09 experts from PCCC and 04 from MNSUAM delivered lectures on various cotton agronomic practices. Participants appreciated the resourcefulness of experts.



ix) World Cotton Day

The Central Cotton Research Institute (CCRI), Multan celebrated the World Cotton Day (WCD**)** on October 7, 2023 with great enthusiasm and in a befitting manner. The day is being celebrated with reassurance for the betterment of cotton crop in the country. The following major activities were carried out:

- Cotton Walk for commemorating importance of cotton crop in economy
- Exhibition of farm machinery and stalls of companies
- Seminar challenges confronting cotton production, measures for its revival
- Perspectives of stakeholders (Farmers, ginning, textile, pesticide, seed and fertlizer)

The event highlighted the issues in cotton production and trade and recommended measures for boosting cotton production in the country. The collaborative and joint efforts by the government functionaries, stakeholders and cotton trading bodies will bring back the momentum of cotton production to the level where it was a few years before and prosperity for the nation at large. The year 2019 led to launch the initiative of declaring World Cotton Day by the ICAC and WTO, followed by events and celebrations around the world commemorating the importance of cotton crop. The United Nations has also declared 7th October as the UN World Cotton Day in 2021. Pakistan being a leading cotton producing country holds responsibility to showcase solidarity with world cotton community. Cotton is not only the lifeline for Pakistan's economy but also has a unique association with mankind.

x) Website & Social Media

The Institute also initiated highlighting of cotton research and development activities carried out during crop season 2023-24 utilizing social media tools (www.fb.com.pk/CCRIM.PK). This has attracted cotton farmers, researchers, and students very effectively. The followers and members appreciated the activities carried out by the Institute. The Institute has also upgraded the website (www.ccri.gov.pk) of the Institute highlighting major cotton research and development activities, brief programs of various disciplines, cotton market rates, weather situation and other related activities.

4. **Central Cotton Research Institute, Sakrand Sindh**

Central Cotton Research Institute, Sakrand, Sindh was established in 1976 by the Pakistan Central Cotton Committee (PCCC) through the Ministry of Food, Agriculture and Cooperatives, Government of Pakistan and is mainly being financed from the Annual Development Programme (ADP) funds of the Federal Government, the paucities being met by the PCCC from its Cess. The institute, as the name goes, is the mono crop, multidisciplinary research organization with an ultimate object of evolving high yielding, early maturing, heat and drought tolerant cotton varieties that resist the prevailing insect pest complex, resistant to CLCuV disease and climate smart cotton varieties along with desirable fiber characteristics.

With the above objective in view, the Institute conducted basic as well as applied research on cotton crop in the disciplines of Plant Breeding/Genetics, Agronomy, Plant Physiology/ Chemistry, Plant Pathology and Entomology sections; whereas, there is lacking of Biotechnology/Molecular Breeding, Fiber Technology, Transfer of Technology and Statistics sections. This collaborative multidisciplinary research work paves a

way to the concerted efforts in achieving the objective with which the organization has been established and leads to the evolution of new cotton varieties with recommended package of production technology. The new development is being disseminated to the farming community through liaison between the Institute and Agriculture Extension Department, Govt. of Sindh. The institute is situated in the center of cotton growing areas of the Sindh province, which is the 2ndlargest cotton producing province of Pakistan. The climate of this province has favorable climatic and ecological conditions for production of high quality and quantity in our country. Institute has only about 50 acres of farm's land to conduct different sections experiments, demonstration plots and multiplication of the commercial cotton varieties for whole province of Sindh, which is Equal to salt in flour.

The Institute has so far developed 16 elite cotton varieties (Bt and Non Bt) since its beginning. Developments have been made in earliness, heat tolerance, drought tolerance, salinity tolerance, disease resistance and fibre quality traits along with weedicide resistance/tolerance. CCRI, Sakrand has developed cotton leaf curl virus (CLCuV) resistant varieties viz CRIS-467 when the country suffered a huge loss and country yield from 13.6 million bales to 8.4 million bales only. In addition to the varietal development, the scientists of the Institute developed water saving planting techniques, pest scouting models and economic threshold levels (ETLs) for various pests, evaluate nutritional requirement of cotton varieties, and addressing soil health issues in the Sindh province. Since its establishment, CCRI Sakrand has made tremendous progress in cotton for various aspects of cotton crop. Some of which are given below:

- Developed CLCuV resistant varieties, high lint percentage (38% - 45%): and staple length (27.0 - 33.0 mm) varieties.
- Developed short-duration varieties (120 to 150 Days; Bt.CRIS-682, CRIS-129, CRIS-510).
- Developed production technology for various regions and IPM strategies for different pests.
- Providing Training of farmers, extension workers, academia and industry.
- The institute has about 3549 germplasm (322 local and 3227 exotic) to maintain and increase genetic diversity for future cotton breeding program.

Detail of genetic stock of world cotton collection.

Local genotypes	322
Exotic genotypes	3227
SPECIES WISE	
Gossypium hirsutum L.	2041
Gossypium barbadense L.	08
Gossypium arborieum L.	939
Gossypium herbaceum L.	239
Total	**3549**

Before the establishment of the Institute three cotton varieties SKD-10/19, Qalandri and NT (New type) were evolved by PCCC at CCRI, Sakrand for general cultivation. Pre-basic and basic seed of all 14 approved varieties (CRIS-9, CRIS-5A, CRIS-134, CRIS-467, CRIS-121, CRIS-342, CRIS-129, Bt.CRIS-508, CRIS-510, CRIS-533, CRIS-585, CRIS-543 and CRIS-613) for distribution among public sector, private seed companies and progressive growers are being produced every year. Development of naturally colored cotton (brown, dark brown & green color) with high yield potential and improved fiber traits are in progress.

Approved varieties of CCRI-Sakrand, Sindh.

Sr. No.	Variety	Year of release	GOT (%)	Staple length (mm)	Fibre Fineness (µg/inch)	Fiber strength (tppsi)/g tex^{-1}
1	SKD-10/19 (Diploid)	1984	40.6	15.5	10.1	80.0
2	CRIS-9	1992	34.5	26.2	4.6	97.0
3	CRIS-5A (Marvi)	2001	34.5	26.5	3.9	97.5
4	CRIS-134	2004	34.5	28.0	4.4	97.0
5	CRIS-467	2004	37.0	27.5	4.5	97.2
6	CRIS-121	2006	38.5	27.5	4.7	98.5
7	CRIS-342	2010	38.5	28.4	4.8	98.5
8	CRIS-129	2016	38.7	28.5	4.3	96.2
9	Bt.CRIS-508	2017	38.2	28.5	4.5	98.7

10	CRIS-510	2017	41.2	28.7	4.4	102.6
11	CRIS-533	2017	41.6	28.9	4.7	90.5
12	CRIS-543	2020	41.3	28.5	4.4	31.0
13	CRIS-A. R. Halipoto	2020	42.4	29.1	4.5	30.6
14	CRIS-613	2020	42.5	28.7	5.0	28.3

Varieties in pipeline:

Two Cotton Varieties (Bt.CRIS-674 and CRIS-644) approved in the meeting of Technical Sub-Committee held on 14-6-2023 at Directorate General, Agriculture Research Sind, Tandojam. These varieties will be recommended soon for general cultivation by the Seed Council Meeting.

Four varieties viz Bt. CRIS- 672, Bt. CRIS- 682, Bt. CRIS- 700,Bt. CRIS- 697 and Bt. CRIS- 714 of this institute are in pipeline for approval in Technical Sub-Committee.

Furthermore the Institute has a lot breeding materials in various filial generation equipped with high potential, insect-pest and disease tolerance along with weedicide resistance/tolerance.

The Institute, since its establishment, remained associated with various national and international organizations for cotton research and development as mentioned below:

- Sindh Agriculture University, TandoJam.
- Center of Excellence in Analytical Chemistry University of Sindh
- Asian Development Bank (ADB)
- CERA USA (Biosafety Research in Pakistan Grant Program)
- Economic Cooperation Organization (ECO)
- Food & Agriculture Organization (FAO) of the United Nations
- International Cotton Advisory Committee (ICAC) USA
- International Cotton Researchers Association (ICRA)
- Organization of the Islamic Conference (OIC)
- South Asian Association for Regional Cooperation (SAARC)
- United Nations Development Program (UNDP)
- USDA (USAID PL-480, Pak-US ICARDA Cotton Project)

RESEARCH ACTIVITIES

Research Experiments

The research experiments conducted during 2023-24 carried out by various sections are as follows:

AGRONOMY

Sr.	Proposed Title of Study/Experiment/project
1	Effect of time of sowing on productivity of advanced genotypes
2	Response of new strains to different nitrogen levels
3	To determine the impacts of plant to plant spacing on seed cotton yield and its components of advanced strains under Sakrand condition.

PLANT BREEDING AND GENETICS

Sr.	Proposed Title of Study/Experiment/project
1	**Zonal Varietal Trials;** Evaluation of early maturing, high yielding, high GOT and medium long staple Bt. strains, long staple Bt. Strains, heat tolerant, CLCV disease resistant/tolerant Bt. Strains in different ecological zones of Sindh
2	**Varietal trials;** Evaluation of high yielding and CLCV disease resistant/tolerant Bt. strains early maturing, high GOT and medium long staple Bt. against commercial variety.
3	**Micro varietal trails; ;** Evaluation of high yielding and CLCV disease resistant/tolerant Bt. strains early maturing, high GOT and medium long staple non-Bt. against commercial variety. Evaluation of high yielding, high GOT with desirable fiber characters Bt. strains against commercial variety. Evaluation of high yielding, heat and drought tolerant Bt.strains against commercial variety. Evaluation of high yielding, early maturing and High GOT % Bt. strains against commercial variety. Evaluation of high yielding, heat tolerant Bt. strains against commercial variety.
4	Testing of Advanced Strains at Farmers' Field in Different Zones of Sindh.

5	Production of pre-basic and basic seed of approved varieties of CCRI-Sakrand.
6	National Coordinated Variety Testing Programme of PCCC.
7	Maintenance and screening of Genetic Stock

PLANT PATHOLOGY

Sr.	Proposed Title of Study/Experiment/project
1	Survey of cotton diseases at CCRI Farm
2	Screening of breeding material for diseases
3	Epidemiological Studies on Cotton Diseases
4	Screening of Breeding Material against CLCuV
5	Disease in Glass House Pathological Studies in NCVT
6	Effect of Plant growth Regulator on CLCV disease and on yield

PLANT PHYSIOLOGY/ CHEMISTRY

Sr.	Proposed Title of Study/Experiment/project
1	Screening of new strains for heat tolerance
2	Screening of new strains for drought tolerance
3	Screening of new strains for salinity tolerance
4	Effect of seed priming on growth and development of cotton.

TRANSFER OF TECHNOLOGY

1	Scientist-grower/farmer linkage
2	TeleCotton clinic SMS Service
3	Integrated Multi-Media Publicity Campaign

Milestones Achieved

- Promoted organic cotton with different novel strategies.
- Genetic breeding of the cotton crop to improve a biotic stress tolerance abilities such as salt, drought and heat and biotic stress like sucking insect complex.

Seminars / Workshops / Training Programs / Meetings

Meetings

- **On 11th July, 2024,**Dr Peer Muhammad Idress Khan, Director CCRI Sakrand along with his research team conducted a pivotal meeting at CCRI Sakrand with the heads and representatives of the various agricultural institutes for strengthening the coordination, collaboration and linkages development between the Institutes.
- **On 4-5th March, 2023,** Miss SairaBano, Senior Scientific Officer**,** attended the meeting of SPDC (seed production development center) at S.A.U, Tandojam.
- **On 14th June, 2023,** Mr. Allah Dino Kalhoro, Director CCRI-Sakrand and DrRehanaAnjum Senior Scientific Officer/Head plant Breeding & Genetics section attended "Technical Sub-committee meeting" for approval of new crop varieties and techniques.at Directorate General Agriculture Research Sindh Tandojam. DrRehanaAnjum presented the cases of two cotton varieties viz., CRIS-644 (Non-Bt) and CRIS-674 (Bt variety) and committee recommended both varieties for Sindh Seed Council.

Trainings and research supervisions

- A total of 4 PhD, 14 MSc (Hons) and 5 Internship (Undergraduate student were supervised during 2023-24.
- A large number of trainings and workshops on Cotton Nutrition (Fertilizer Application Methods and time), Soil Health, Climate Change, Better Cotton Principles and Criteria have been delivered to farmer communities and private sector organizations.

Research publications

The scientists of this Institute published 13 research articles papers in different journals of national and international repute.

5. Directorate of Marketing and Economic Research

Established in 1979, the Directorate of Marketing and Economic Research (DMER) focuses on understanding the demand for Pakistani cotton, exploring market potential, assessing production capabilities, and assisting authorities in production planning, policymaking, execution, and monitoring of various economic programs. The DMER evaluates the cotton situation, monitors ginning operations and cotton movements throughout the season, and closely tracks prices, consumption, exports, and stocks. This data and analysis support authorities and policymakers in developing and implementing cotton production plans. The information also aids growers, ginners, cotton exporters, and researchers in maximizing the benefits of their efforts. The DMER's activities have significantly emphasized the economic importance of cotton, guiding researchers in the right direction. The directorate conducts studies on marketing research and cotton development programs related to production, trade, and utilization.

Functions of DMER

The Directorate of Marketing and Economic Research (DMER) conducts studies and investigations on the economic and marketing aspects of cotton at both fundamental and applied levels to understand economic factors and suggest remedial measures. DMER regularly provides data, facts, and figures on all aspects of cotton to various divisions within the PCCC, the Ministry of National Food Security & Research, other ministries and departments, research organizations, and trade associations. This information is also shared with international organizations such as the ICAC, FAO, World Bank, and Japan Cotton Spinners Association.To disseminate this information, DMER regularly publishes:

- Daily Market Report
- Monthly Cotton Review
- COTISTICS, the Annual Cotton Statistical Bulletin

Following is a brief summary of cotton crop situation and its rates in domestic and international markets during 2023-2024.

6. Cotton Crop (2023-24) in Pakistan

The cotton crop in Pakistan for the financial year 2023-24 witnessed varying levels of success across different provinces. The following report details the targets and achievements in terms of area cultivated and production, highlighting the percentage achievements against the set targets.

The targets and achievements of the cotton crop in 2023-24, measured in million hectares (Ha) for area and million bales for production (where one bale equals 170 kg), are summarized in the table below:

Targets & Achievements of Cotton Crop 2023-24			**(Bale=170Kg)**			
Province	**Area (Million Ha)**		**Production (Million Bales)**		**% age Against Target**	
	Target	**Achievement**	**Target**	**Achievement**	**Area**	**Production**
Punjab	2.018	1.68	8.336	6.028	83.25%	72.31%
Sindh	0.671	0.61	4.000	3.8796	90.91%	96.99%
KPK	0.002	0.00018	0.004	0.00012	9.0%	3.00%
Baluchistan	0.073	0.0768	0.430	0.315	105.21%	73.26%
Total	**2.764**	**2.367**	**12.770**	**10.223**	**85.64%**	**80.05%**

Source: Pakistan Bureau of Statistics

Punjab:
Area: The target was 2.018 million hectares, with an achievement of 1.68 million hectares, resulting in an 83.25% achievement against the target.
Production: The target was 8.336 million bales, with an actual production of 6.028 million bales, achieving 72.31% of the target.

Sindh:
Area: The target was set at 0.671 million hectares, with an actual achievement of 0.61 million hectares, resulting in a 90.91% fulfillment of the target.
Production: The target was 4.000 million bales, with an actual production of 3.8796 million bales, achieving 96.99% of the target.

Khyber Pakhtunkhwa (KPK):
Area: The target was 0.002 million hectares, with an achievement of 0.00018 million hectares, resulting in a 9.0% achievement against the target.
Production: The target was set at 0.004 million bales, but the actual production was only 0.00012 million bales, achieving just 3.00% of the target.

Baluchistan:
Area: The target was 0.073 million hectares, with an achievement of 0.0768 million hectares, exceeding the target with 105.21% achievement.
Production: The target was 0.430 million bales, with an actual production of 0.315 million bales, achieving 73.26% of the target.

Pakistan:
At the national level, the sowing target was set at 2.764 million hectares, with an achievement of 2.367 million hectares, resulting in an 85.64% accomplishment of the target. For production, the target was 12.770 million bales, with an actual production of 10.223 million bales, achieving 80.05% of the target.
The overall performance of the cotton crop in Pakistan for the financial year 2023-24 shows a moderate level of success. While the total area under cultivation reached 85.64% of the target, the total production achieved 80.05% of the target. Punjab and Sindh, the major cotton-producing provinces, showed significant achievements in both area and production. However, Khyber Pakhtunkhwa struggled to meet its targets, while Baluchistan exceeded its area target but fell short in production. The data reflects the diverse agricultural conditions and challenges faced across the country.

Cotton Rates in Pakistan during 2023-24

Across Pakistan, Seed Cotton prices varied from 7,274 PKR per 40 kg in October 2023 to 9,456 PKR per 40 kg in March 2024, with an annual average price of 8,233 PKR per 40 kg. The table below summarizes the monthly rates for Lint and Seed Cotton in Punjab, Sindh, and Pakistan as a whole:

Average Rates of Cotton Commodities in Season 2023-2024 (Rupees/40kg)				
Month	LINT	SEED COTTON		
		PUNJAB	SINDH	PAKISTAN
Aug-23	19579	8434	7845	8140
Sep-23	20217	8931	7920	8426
Oct-23	17892	7759	6788	7274
Nov-23	18720	7843	7111	7477
Dec-23	18230	7865	7061	7463
Jan-24	20193	8966	7557	8262
Feb-24	22664	9368	NA	9368
Mar-24	23042	9456	NA	9456
Annual Average	19139	8578	7380	8233

Source: KCA, Market Committees

Lint Prices:

Lint prices ranged from a low of 17,892 PKR per 40 kg in October 2023 to a high of 23,042 PKR per 40 kg in March 2024. The annual average price for Lint was 19,139 PKR per 40 kg.

Seed Cotton Prices in Punjab:

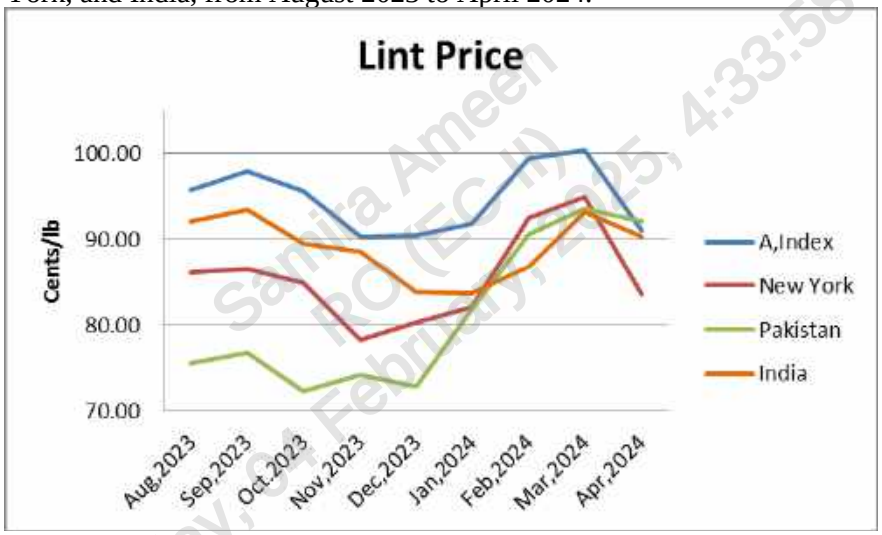
In Punjab, Seed Cotton prices fluctuated between 7,759 PKR per 40 kg in October 2023 and 9,456 PKR per 40 kg in March 2024, with an annual average price of 8,578 PKR per 40 kg.

Seed Cotton Prices in Sindh:

Prices in Sindh ranged from 6,788 PKR per 40 kg in October 2023 to 7,920 PKR per 40 kg in September 2023. The annual average price for Seed Cotton in Sindh was 7,380 PKR per 40 kg.

A. Comparative Analysis of Cotton Prices in Pakistan and the World (2023-24)

The chart illustrates the comparative rates of Lint in Pakistan alongside global benchmarks, including the A Index, New York, and India, from August 2023 to April 2024.



Trends Observed:

1. **A Index**:
   - The A Index, representing an international cotton price average, started at a high of around 97 cents/lb in August 2023, experienced a slight decline to around 91 cents/lb by December 2023, and then peaked at 98 cents/lb in March 2024 before slightly dropping again in April 2024.

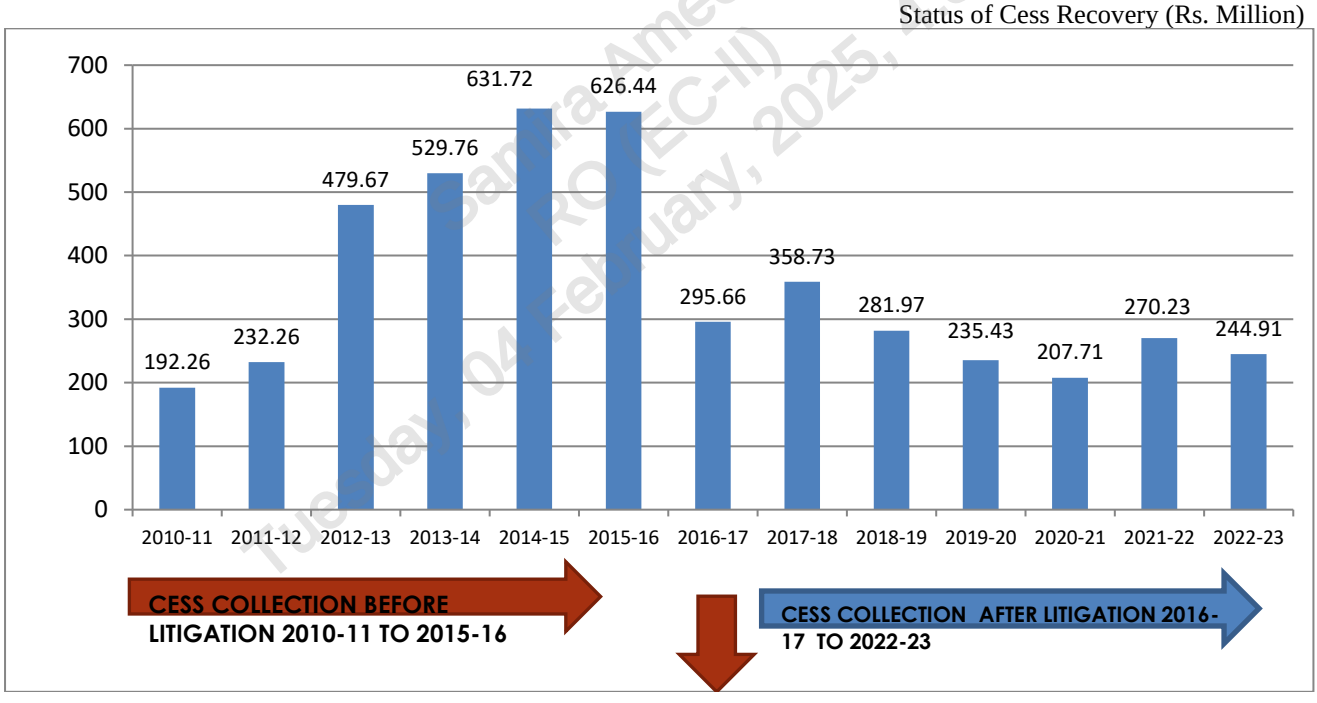
2. **New York**:
    - New York cotton prices showed a downward trend from August 2023, starting at approximately 87 cents/lb, reaching a low of about 78 cents/lb by December 2023, and recovering to around 89 cents/lb in March 2024, before dipping to 85 cents/lb in April 2024.
3. **India**:
    - Indian cotton prices started at around 92 cents/lb in August 2023, gradually declined to approximately 83 cents/lb by December 2023, remained stable till February 2024, and then rose to around 90 cents/lb in March 2024 before declining slightly in April 2024.
4. **Pakistan**:
    - In Pakistan, cotton prices began at a lower point of around 73 cents/lb in August 2023, showed a consistent decline reaching about 72 cents/lb by January 2024, and then sharply increased to approximately 89 cents/lb in March 2024, aligning closely with other global rates, before stabilizing in April 2024.

Throughout the observed period, the A Index consistently remained the highest, followed by prices in India and New York, with Pakistan generally showing the lowest prices until the substantial increase in early 2024. The comparative analysis of cotton prices indicates that while Pakistan's cotton prices started significantly lower than international prices, they experienced a substantial increase in early 2024, aligning more closely with global trends. This highlights the dynamic nature of the cotton market in Pakistan and underscores the importance of monitoring international price movements to better understand local market behavior and strategize accordingly.

7. Major Challenges

- Over the past few years, the textile industry reduced paying the cotton cess in full, resultantly the gradual decline of the R&D programs carried out by the PCCC. Now the situation is that the organization could disburse only 30-35% of salaries and pension to its employees.
- The textile industry is not paying cotton cess in full during the past two years, and has gone into courts against levy of cess. The amount of more than Rs.3.5 billion is outstanding against textile mills, for which no mechanism for recovery is yet framed. Due to shortage of funds, PCCC could only disburse 30-40% of the salary and pension to the employees since June 2022.
- Research work has also suffered badly. The research on cotton biotechnology and other advanced technologies could not be initiated due to shortage of funds and the required number of scientific and technical staff. The posts of lying vacant over the years. Out of the total 752 sanctioned posts, only 224 officers/officials are existing.

Status of Cess Recovery (Rs. Million)



v) Potential Remedies

Financial Improvements

1. Enhancement in Cess Rate from Rs.50 per bale to Rs. 200 per bale
2. Formulation of Special Task Force for recovery of pending cotton cess of Rs.3.5 billion through Provincial Chief Secretaries to ensure collection from textile units. Sugarcane Cess collection is an example.
3. Collection through FBR or District Management may also be considered.
4. Textile Units to be bound for compulsory NOC from PCCC in case of availing subsidies, export/import permit or any other govt package and facility.

Research Improvements

1. Endowment Fund of Rs. 10 billion
2. Funding of Cotton Projects through PSDP
3. Collaboration with SIFC/CPEC
4. Recruitment on Key Posts (Scientists, Admn& Accounts, IT)

14. PAKISTAN COTTON STANDARDS INSTITUTE (PCSI)

Preparation of standards boxes

Demonstration in pcsi, cotton fiber testing lab

Demonstration in Ginning Factory with

Demonstration in Ginning Factory with KCA

Training on Classing and Grading

Demonstration at Cotton Farmhouse


Working with TCP Official's visit at PCSI

PAKISTAN COTTON STANDARDS INSTITUTE

1. Introduction

Pakistan cotton is inherently of good quality. But, lack of quality control measures, improper marketing and as well as non-existence of a quality based pricing system subject to premium and discounts leads to depreciation of the value of raw cotton and the resulting textile products. Being cognizant of these problems, the Government decided to introduce standardization of cotton and bring it at par with the internationally accepted standards for improving the competitiveness of Pakistan's raw cotton as well as ensuring better returns to cotton growers, ginners, spinners, exporters and the national economy.

PCSI is functioning under Cotton Standardization (Amendment) Act, 2009 that include providing cotton sample testing services to various stakeholders of cotton, conduct cotton selectors training courses , prepare seed cotton grade and lint cotton standard boxes , provide trainings to female master cotton pickers, organize demonstrations at field and ginning factories, distribution of informative literature among growers and ginners in regional languages, arrange technical workshops and seminars and perform other related activities. Further PCSI has also been providing training to members of KCA at their premises for the last several years at their request.

Presently PCSI is operating with its Head office at Karachi, two Regional offices at Multan & Sukkur and 10 cotton fiber testing laboratories(CFTLs) i.e Karachi, Sanghar, Mirpurkhas at Sindh and Rahim Yar Khan ,Bahawalpur, Multan ,Faisalabad, Vehari, Sahiwal and DG Khan at Punjab.

2. Policy Frame Work:

Realizing the importance and role of cotton sector in National economy the Government is making serious and continuous efforts to meet the up-coming challenges which the international competition has forced for doing things properly and up to the International standards.

Textile sector of the country on which National economy heavily relies is demanding upon to control costs, reduce wastages and improve productivity levels in terms of quality, for attaining a valuable and sustainable position in the Global cotton market. Pakistan Textile sector direly needs for standardized and clean cotton.

Keeping in view the emerging competitive global market and the grant of GSP plus status to Pakistan by European Union, Pakistan has accordingly reorganized its policies focusing quality in order to fetch the real share from the international cotton market.

Henceforth in order to address the problem Government framed a policy to upgrade the Pak. cotton quality to bring it at par with international standards and in the light of government policy PCSI prepared a frame work to achieve result oriented goals through the implementation of cotton standardization system.

3. Vision/Mission and Goal :

Vision:

i. Enhancement of Pak cotton quality through cotton standardization program.
ii. To bring Pak cotton as par international standards.
iii. To ensure real intrinsic value of Pak cotton and its made-ups from the international market.

Mission:

i. Education/ Awareness Campaigns for implementation of standardization system.
ii. Human Resource Development.
iii. Proper picking and handling procedures better cotton quality.
iv. Improved ginning practices to standardized and clean cotton.
v. To produced contamination-free cotton.
vi. Incentive Based Marketing System to all stake holders.

Goal:

For the production of high quality standardized and clean cotton following goals have been set:

i. Improvement of Picking/Handling/Ginning practices.
ii. Instrumental Evaluation of Cotton.
iii. Human Resource Development.
iv. Incentive based marketing system.

4. Progress/ Activitiesduring2023-2024

Training Programs:

COTTON SELECTORS TRAINING COURSE:

Cotton Selectors Training Course is one of the popular programs and has significant response from public &private sector. This is a four week training programconduct at PCSI Head Office Karachi and Regional offices Sukkur and Multan (two courses each). One of the main objective of PCSI is to train new generation of skilled persons in the skills of Cotton Classing and Grading. PCSI is regularly conducting training programs in Cotton Grading/Classification and instrumental evaluation of cotton.The program provides opportunity to the participants to get training in the basic skills of cotton grading and classification .Tilldate over **2760** personnel have been trainedthrough this program. Recently**36** participantsbenefited from the training program which was widely acclaimed by the cotton sector.

5. Cotton Fiber Testing Services to public & private Sector:

The Cotton Fiber Testing Laboratories established by PCSI in the districts of Sindh at **Karachi, Mirpurkhas, Sanghar** and Punjab at **Rahimyarkhan, Bahawalpur, Multan, Vehari, D.G. Khan, Sahiwal,** and **Faisalabad** are fully operational and providing high quality testing services to the stakeholders of cotton. This has laid a strong foundation for developing cotton quality culture in the country and help in shifting over the present cotton marketing system to a quality based marketing system on the basis of grade, staple length and other cotton fiber properties subject to premium and discount. These labs provide comprehensive range of testing facilities under one roof.

6. Cotton Fiber Testing Services to National TextileUniversity, Faisalabad:

The Ministry of National Food Security and Research is committed to facilitate the textile research institutions of the country though modernizing infrastructure and logistic support to undertake research and

development work in the sector. PCSI Cotton Fiber Testing Laboratory, Faisalabad equipped with HVI 1000 classing& Shirley Analyzer Machines MK II UK is providing test house facilities to National Textile University, Faisalabad to facilitate researchers, scientists of the university beside its routine commercial testing services to the public and private sector.

7. Targets and Achievements during the year 2023-24

Targets and the achievements made during the year 2023-24is as follows:

(i) Education awareness campaigns:

Education and awareness campaigns are being regularly held to create quality culture in the cotton sector. For the purpose in the year 2023-24 informative literature regarding proper picking,handling and ginning practices have been prepared in regional and national languages and provided/ distributed to the stake holders of cotton & cotton trade.

(ii) Cotton Selectors' Training Course:

During 2023-24one Cotton Selectors Training Coursehas been organized at PCSIRegional Office, Multan in the month of Aug2023.Through thiscourse 36personnel from public and private sector have been trained in the skills of cotton classing and grading. Since the introduction of these training courses 2760 persons have been trained till date.

(iii) Cotton Sample Tested at PCSI Laboratories:

Cotton Fiber Testing facilities have been provided to public and private sector and about**5004samples**have been tested at the Cotton Fiber Testing Laboratories of PCSI during 2023-24. In order to increase the testing capability PCSI is planning to upgrade its labs through Funding of PSDP.

(vi) Seed Cotton Grade and Lint Cotton Grade Boxes:

280 boxes of seed cotton grades and 450 Lint cotton standards boxes were prepared for the cotton season 2023-24. The said boxes have been provided to the stakeholders of cotton on demand.

S.No	YEAR	Seed Cotton Boxes	Lint Cotton Boxes
1.	2023-24	280	450

(vi)On Farm/ Cotton Ginning Factory Demonstration:

In order to increase proper ginning practices 20on ginning factory demonstrations and 22 on Farm demonstration are carried out at district level by PCSI Technical staff posted at cotton fiber testing laboratories at Sindh and Punjab.

(a) Purpose of Demonstrations :

Toimprove the cotton quality /grade by implementation PCSI Standardization system**.**

(b) Suggestion/Recommendation provided to the ginning factory management

1. To apply the PCSI standardization/grading system.
2. Advised to make grade wise heaps of seed cotton and before ginning properly drying the seed cotton, Dandaryand Khalary system must be applied.

3. The mash of the ginning machine must be properly clean after every 15 minutes.

4. Moisture must be contained up to 8.5% in lint cotton etc.

(vii) PCSI and TCP Joint Working Relationship:

PCSI and TCP jointly working to support the growers and ginners to control the cotton market price.

8. Organizational Resources:

As per provision of Cotton Standardization Ordinance 2002 PCSI has to acquire self financing status and for the purpose MINTEX in compliance of cabinet decision vide S.R.O. No.1013(1)/2006, dated 29-09-2006 has fixed the Cotton Standardization Fee(CSF) at the rate of Rs.5 per pressed bale at the ginning stage. From 2006-2007 ginners paid Rs: 6,657,773/- till June 2023 against CSF and an amount of Rs: 992.00 millions is still outstanding.During 2021-22 &2023-24 ginners did not deposit the CSF.PCGA filed writ petition in Lahore High Court Multan Bench Multan, petition was dismissed on 2017.PCGA Intra court appeal filed in Sep-2017 in Lahore High Court Multan BenchMultan which was also dismissed on April-2019.Despite the dismissal the PCGA is not depositing amount against CSF.

It is important to mention that during **2023-24** the Institute generated around **RS.1,438,320 (Fourteen lac thirty eight thousand three hundred twentyonly)** as annual income.

The above collected income is quite in-sufficient for meeting establishment and operational expenditure. Thus PCSI is being granted annual budget to meet its establishment and operational charges.

9. Issues and Challenges:

- Implementation of the amendments made in Provincial Cotton Control Act, 1966/ Rules by the agriculture departments, governments of Sindh and Punjab to control contamination in cotton.
- Non-Collection of Cotton Standardization Fee @ Rs.5/- per pressed bale from the ginners. Till date an amount of Rs.6.570 million has been deposited by the ginners since 2006-07 whereas approximately Rs. 992.000Million is still outstanding .
- Non availability of sufficient Funds for up-gradation of Cotton Fibre Testing Laboratories in Sindh and Punjab.
- Post of Regular Director (BS-20) vacant since 1998.
- Shortage of technical and other staff.
- Implementation of Pension or Gratuity as per PCSI Service Rules, 1995

10. Future Out-look/Plans:

1. Implementation ofamended Cotton Control Act, 1966 to control contamination in cotton and mandatory marking of grade and staple length on each bale by the ginners.
2. To shift over the present cotton marketing system to a quality based marketing system on the basis of grade, staple length and other fibre properties subject to premium and discount.
3. Up gradation of Cotton Fiber Testing Laboratories Equipped with HVIs.
4. Production of Standardized and Clean Cotton subject to premium/discount to growers/ginners.
5. Strengthening of PCSI with men and machine.
6. Launch education/awareness campaignsin all cotton producing districts to develop a quality culture in the country through print/Social media and by conducting increased number of training courses.
7. Arrangeon Farm /Factory demonstrations / Seminars/ Workshops /Training programs in various cotton producing districts.
8. Organize other activities related with enhancement of cotton quality.

15. PAKISTAN AGRICULTURAL STORAGE & SERVICES CORPORATION LTD(PASSCO)

1. GENERAL

i. PASSCO is a commercial entity registered as a Public Limited Company (unlisted) under the Companies Act, 1913 (now Companies Act, 2017) and working under the administrative control of Ministry of National Food Security & Research, Government of Pakistan, Islamabad. Its 75% paid up capital is held with 6 scheduled banks and remaining 25% is held with Federal Government. Its 3 Directors out of 9 are appointed by Federal Government. SecretaryM/o NFS&R is Ex-Officio Chairman of the Board and Managing Director, PASSCO is CEO / Ex-Officio Member of the Board of Directors.

ii. PASSCO is a self- sustained organization, it does not get any budgetary allocation /grant from the Federal Government to run its operations. It has maintained standard norms of excellence in performance, operating efficiency, credit worthiness, marketing achievements and observance of best financial practices. It's all operations are undertaken through cash credit limits financed by bank borrowings and it has progressively developed strong financial base and resilient functional capacity over the years.

2. MISSION OF PASSCO

a. Facilitate the Federal Government in its quest to ensure **national food security** by **maintaining strategic reserves** of different food grain commodities, providing the same to deficit provinces / areas and armed forces.

b. Ensure **implementation of support price to stabilize the prices**and extend **state welfare** to farmer community.

3. FUNCTIONS

a. Provision of food security at National Level, by maintaining 2.0 Million Ton of Strategic Reserves of Wheat (including 0.08 Million Ton as SARRC Wheat Reserve).

b. Extending state welfare to farmers by providing support price and stabilize prices by intervening in domestic market.

c. Release wheat to deficit provinces/ recipient agencies as well as Armed Forces.

4. ACTIVITIES / ACHIEVEMENTS RELATED TO WHEAT PROCUREMENT 2022-23

Activities related to wheat procurement operation during the year 2023 are as under:-

a. Wheat Procurement Target of 1.8 Million Metric Ton was given by the Government of Pakistan to PASSCO for the Crop 2023. Against the target of 1.8 Million Metric Ton, a quantity of 1.13 Million Metric Ton has been achieved so far. The reasons for not achieving the procurement target include but not limited to hoarding of wheat, higher MSP in Sindh &Balochistan and rate differential in MSP and market price.

b. ECC of the cabinet approved to import a quantity of 3.0 MM Tons vide Case No.ECC-115/10/2021 dated 31st March, 2021 against which a quantity 2.6 MM Tons was imported through TCP. A quantity of 1.29 Million Metric Ton imported wheat was dispatched to Provinces/ Recipient Agencies (with effect from 01.04.2020 to 31.03.2023) and 1.34 Million Metric Ton was carried

forward (01.04.2023) to the Crop Year 2023.

5. STORAGE CAPACITY

a. Since 2015, PASSCO has constructed from its indigenous funds 51 Godowns having storage capacity of 69.524 Metric Tons, thus increased its total storage capacity from 502,958.4 Metric Tons to 572,482.4 Metric Tons.
b. During fiscal year 2022-2023, PASSCO has spent an amount of **Rs.32,109,173/-** on account of repair/maintenance & rehabilitation of PASSCO godowns, silos and other allied structure for smooth & efficient function of infra-structure.
c. PASSCO has been working on establishment of modern silos throughout the Country to enhance its storage capacity. In this regard, PASSCO on the directions of M/o NFS&R has prepared PC-I for construction of 1.0 Million Metric Ton concrete silos having estimated cost of Rs. 25 Billion. Further, M/o NFS&R has engaged Public Private Partnership Authority (P3A) to conduct a feasibility study on a PPP Model.
d. PASSCO has been working to convert its Head Office and Purchase Centers on Solar System to reduce the operational expenses and save electricity costs. A pilot project of 2 KW Solar System has been installed in Hafizabad Zone.

16. Livestock and Dairy Development Board (LDDB)

Livestock and Dairy Development Board (LDDB) is a company registered under section 42 of the Companies Act, 1984. LDDB has been declared autonomous organization by the Cabinet Division vide letter no.4-11/2019-Min-I dated 14th April, 2020 under the administrative control of Ministry of National Food Security and Research**.** Inclusion of Board of Directors of LDDB in the light of State Owner Enterprises (SOE) Act-2023 is in progress. The main objectives of Livestock and Dairy Development Board are promotion and facilitation for accelerated development and investments in the livestock, poultry, and dairy sector in Pakistan. In the year 2023-24, under the directions of honorable IHC Mr. Aqib Anwar, CA was appointed Administrator LDDB. During above mentioned period five project concept notes as well as four PC-I submitted to the Ministry for consideration and release of funds through PSDP. Information was gathered from provincial as well as regional collaborators of Prime Minister's Initiative projects for submission of PC-IV to the concerned quarters. Efforts were made to functional Livestock Business Resource Centre (LBRC). Three concept notes were also submitted to Ministry to seek funding through TIKA.

17. FISHERIES DEVELOPMENT BOARD(FDB)

Structure:

Fisheries Development Board is a Guarantee limited Company established in 2007 under Section 42 of the Companies Act. (1984) and is working under Ministry of National food Security and Research

Objectives:

The FDB to serve as a bridge between the government and the private sector and is mandated for the following tasks:

i. Coordination of national and provincial activities with relation to fisheries and aquaculture.
ii. Promotion of investment in fisheries and aquaculture sector.
iii. Promote joint ventures between foreign and local investors.
iv. Help the government to create an enabling environment, establish a regulatory framework, and enforce total quality management and other related areas for promotion of fisheries across the value chain.
v. Prepare and implement plans for awareness development and capacity building both in the public and private sector relating to fisheries and aquaculture.
vi. Prepare and implement plans according to regional specific requirements.
vii. Play a due role and development of market infrastructure and improvement of marketing of fisheries products.
viii. Explore and enable export markets for Pakistani fisheries products.

Membership of the Board of Directors

Federal Government:

Secretary MNFSR

Provincial Government:

- Four provincial secretaries dealing with Fisheries Developments.

Private Sector:

- Six representatives including: one from research organizations/universities, five fish farmers/fishers from Punjab, Sindh, KPK, Baluchistan and GB.

Achievement During The Last One Year (23-24)

1. Pilot Project for Development of Shrimp Farming Cluster

1. **Project Cost:** 6381.86 M (Federal Component 1350.33M)
2. **Gestation Period:** 5 years
3. **Project Areas:** Punjab, Sind & Baluchistan
4. **Expenditure 23-24:** 289.196 M

Federal Component

1. PIU established.
2. Model Shrimp Farm, Civil work in progress. Earthen pond completed. Tube well installed and functional and other civil work of nursery complex and office cum training building is in progress.
3. Land of Shrimp Hatchery Acquired at Daam Town District, Lasbella, Balochistan. Funds transferred to Pak-PWD and the shrimp hatchery site handover to Pak PWD for the civil works. Civil works of shrimp hatchery is in progress. Construction of approach road, boundary wall and retaining wall is in progress. (60% completed)
4. 6 Seminar/workshops have been conducted at Karachi, Lahore and Islamabad on promotion of shrimp farming and export development in Pakistan.
5. The 544 Farmers and 25 extension workers have been trained in shrimp farming practices.
6. National Residue Control Plan (NRCP) is finalized, amendments in "Pakistan Fish Inspection and Quality Control Rules 1996" have been made and shared with provinces for the implementation.

Punjab Component

1. Civil work for the construction of Saline Water Aquaculture Research Center is 90% completed in Muzaffargarh.
2. Civil work completed for up gradation of the training center and hostels at Rawalpindi and Bahawalpur. (100% completed).

Targets for Forthcoming Fiscal Year 2023-24

1. 200 farmers and extension workers will be trained for shrimp farming.
2. Civil work of Shrimp Hatchery may be started again, subjected to the availability of funds and approval of revised PC-1.
3. Civil work of Model Shrimp Farm will be completed at PindDadan Khan District Jhelum (100% civil work will be completed), subject to the availability of funds. The farm is ready for stocking of shrimp from.

Pictorial View of Project:

Civil work Model Shrimp Farm PD Khan

Civil Work of Shrimp Hatchery in Damb Balochistan

Shrimp Farmers Training Program

Saline Water Aquaculture Research Center (Punjab Component)

2. Cage Culture Cluster Development Project

1. **Project Cost:** 4965.50 M (Federal Component 680.09 M)
2. **Gestation Period:** 5 years (Closed on 30th June, 2024)
3. **Project Areas:** Punjab, Sind & Baluchistan
4. **Expenditure 23-24:** **53.688,163** M

Achievements

Federal Component

1. PMU established at FDB office.
2. Establishment of three model cage farms completed.
3. Demonstration of Cage Fish Farming for training purpose.
4. 50 Master Trainers trained.
5. 821 fish farmers, fish farm workers and stockholders have been trained.

Punjab Component

1. PIU established
2. 1310 cages have been installed on selected water bodies all over the Punjab on Subsidy basis.
3. Three fish health labs have been established in Punjab at Multan, Gujranwala, and Sargodha.
4. Fish extension services strengthened.

Model Marine Cage farm at Damb District Lasbella, Balochistan

Farmers Training Program

Fish Health Labs at Multan, Gujranwala and Sargodha

3. Promotion of Trout Farming in Northern Areas of Pakistan

1. **Project Cost:** 2355.13(Federal Component1554.98M)
2. **Gestation Period:** 5 Year
3. **Project Areas:** Khyber Pakhtunkhwa, AJK & GB
4. **Expenditure 22-23:** 271.3 M

Achievements in FY: 2023-24

1. Establishment of Trout Hatchery at Mansehra, KP The Civil Work is 90% completed.
2. The target of identification of 10 Nos. sites and construction of trout farms in the private sector in KPK, 5 trout farms and 5 warm water farms in AJ&K were left undone due to unavailability of funds.
3. Establishment of Cold-Water Fisheries Research Centre at Swat, KP. The Civil work is 85% is completed and rest is in progress.
4. Training of 134 Nos. officials and private farmers has been conducted in GB.
5. Civil work for the establishment of the Directorate office in GB is 90% completed.
6. Rehabilitation of Chikkar fish hatchery and repair work of other hatcheries in GB has been 80% completed.
7. The establishment of a trout hatchery in AJ&K is 50% completed.
8. Procurement of equipment for cold storage centers was left undone due to unavailability of funds.

Targets for Forthcoming Fiscal Year 2024-25

KP component:

1. Construction of trout hatchery in Siran Valley, Mansehra will be completed.
2. Construction of Cold-Water fisheries, Research, and Training Center in KPK will be completed.
3. Identification of new sites and construction of trout farms in the private sector in KPK will be completed

GB component:

1. Establishment of Cold storage in Ghizer and Skardu will be completed and equipment will be procured.
2. New cages will be purchased and installed at blind lake Shigar.
3. Establishment of the Directorate office and AD Office will be completed.
4. Training of 30 fisheries officers will be completed.
5. Rehabilitation & Repair work of one hatchery at Guru Juglote will be completed.

AJK component:

1. Remaining work (20%) of Rehabilitation & Repair of (06Nos) hatcheries will be completed.
2. One new hatchery at Jehlum Valley will be completed.
3. New trout farms 22 Nos will be completed.
4. Warm Water farms 19 Nos will be completed.
5. Procurement of equipment for new hatchery will be completed.

Pictorial view of Project Activities

Trout Fish Hatchery Mansehra-KP

Construction of New Trout Farms in KP

Construction of research and training center, Swat, KP

Construction of Trout Hatchery, Compound wall and Protective gabion Sogha Village Ghanche

Sogha Trout farm Ghanche


Construction of Trout Hatchery NiasloShigar& supervisor office.


Renovation of warm water Chikar Hatchery

Fishing and Angling tournament in GB

Capacity building & Training activities

Distribution Of Fish Feed And PPE.S To Private Farmers In District Gilgit

18. PAKISTAN TOBACCO BOARD

Overview

Pakistan Tobacco Board is a statutory body set up in 1968 through an Ordinance (Ordinance No. 1of 1968) by the Federal Government mainly to promote tobacco cultivation on scientific lines to meet domestic and export demand. Since its establishment. PTB was place under the administrative control of Ministry of Commerce. However, the Federal Government placed the organization the administrative control Ministry of National Food Security & Research (NFS&R) in December, 2019. The Board is a regulatory-cum–research body and is not engaged in any commercial or trading business.

STAFF STRENGTH

S. No	Basic Pay Scale	Sanctioned Strength	Working Strength
1.	22/21	01	01
2.	20	-	-
3.	19	04	02
4.	18	18	14
5.	17	51	31
6.	16	11	07
7.	15	10	10
8.	14	09	05
9.	13	18	17
10.	12	02	02
11.	11	17	10
12.	10	-	-
13.	09	24	21
14.	08	-	-
15.	07	01	01
16.	06	05	04
17.	05	10	07
18.	04	11/01	10/01
19.	03	06	06
20.	01/02	105	95
Total		**304**	**244**

ACTIVITIES OF RESEARCH & DEVELOPMENT WING, PTB DURING THE YEAR 2022-23

Activities of the Research and Development (R&D) wing of Pakistan Tobacco Board (PTB) during the period 2022-23 are summarized as below:

Sr. No	PERIOD		ACTIVITIES
1	January	February	Field days/workshops, Preparation of Annual Technical Report, Meeting with fertilizer and pesticide companies,
2	March	April	Demonstration plots/nurseries at farmers' field regarding land preparation, ridge making & transplantation.
3	May	June	Topping/ De-suckering, Data collection, Repair of Curing Barns.
4	June	August	Picking/Harvesting, Curing, Sample Collection for physio-chemical analysis
5	July	September	a) Grading, Bailing, Marketing of tobacco. b) Monitoring the marketing of tobacco in various tobacco growing areas to check marketing malpractices and ensuring that the growers get prices above Minimum Indicative Price (MIP).

6	October	November	a) Leaf, Soil analysis for recommendations, Preparation of Research & Development Plans (Research Trials), meeting of Annual Research Co-Ordination Committee to approve the plan. b) Conduction of the Cost of Production (COP) survey all over the tobacco growing areas in the country.
7	November	December	a) Preparation of Seed beds, Layout of nursery trials, Sowing of tobacco seeds for nursery preparation. b) Physical verification of burnt barns in different tobacco growing areas /districts of Khyber Pakhtunkhwa.

- Meeting of Research and Co-Ordination Committee was arranged to approve Research and Development Plan (R&D Plan).
- Development staff conducted Cost of Production (CoP), Burnt Barn Verification surveys and supervised marketing of tobacco crop.
- Arranged fertilizer Meeting with fertilizer and tobacco companies regarding recommendation and availability of fertilizer.
- Arranged pesticide meeting with pesticide and tobacco companies to discuss the availability and distribution of effective pesticides.

BUDGET ALLOCATED DURING THE YEAR 2022-23

Crop Research/Extension Work (Budget allocated 2022-23)	Laboratory Budget (Budget allocated 2022-23)
Rs. 15 million	Rs. 0.4 million

ACHIEVEMENTS OF RESEARCH AND DEVELOPMENT WING, PTB DURING THE YEAR 2022-23

Performance of the R&D wing of PTB during the period 2022-23 is summarized as follows:

Activity	2022-23
No of Research Trials	20
Tobacco Leaf Analysis	428
Soil Analysis	44
Water Analysis	239
Fertilizer/Mineral	293
Assisted Students in MSc/BSc Research	12
Workshops: a) Mega Workshops b) Corner Meetings	 10 110
Model Plots	41
Radio Talks	31

- PTB previously completed Turbo barn modification project successfully to save fire wood. In continuation of the same, a project of Automation of Barns is under trial which will further reduce the use of fire wood.

Detail	Conventional Barn	Turbo Barn	Automated Barn
Fire Wood consumption per Barn	1235 Kg	1035 Kg	925 Kg
Days to Cure	07	06	05

Off-grades	06%	04%	03%
Uniformity in Grades	NIL	Nil	Yes
Skilled Labour	Required	Required	Not Required

- Introduced new tobacco growing area i.e. Layyah, Mianwali for cultivation of Sun Cured Virginia tobacco (SCV) which cure without the use of firewood.
- Introduced float tray system of nursery raising for healthy and disease-free seedlings with ease of transplantation.
- Introduced drought tolerance lines of tobacco for cultivation in water deficient areas.
- With the collaboration of tobacco companies and FSC&RD, PTB has enlisted PVH-1600 hybrid variety having good yield potential after successful trials and adoptability in our environment during 2022-23 however, RJR-603, RJR-213 & RJR-217 varieties are recommended for enlistment, while 09 other were also enlisted previously.
- Presently Following hybrid are under testing at our Stations:

1. **GLR 20443001**
2. **GLR 20443003**
3. **GLR 20443005**

- Published Research & Development Plan for the year 2022-23 (copy enclosed).

MARKETING

Pakistan Tobacco Board recommends Minimum Indicative Price (MIP) for various types of tobacco to the Federal Government every year and then regulates marketing of the crop during the purchase season. Major functions of PTB with respect to marketing of tobacco crop are as follows;

i. Announcement of yearly requirements to Tobacco Companies/Dealers.
ii. Verification of Agreements between growers and purchasers.
iii. Distribution of Spilled over Leaves (SOL) fund among tobacco growers affected due to burning of their Barns.
iv. Cost of Production determination for fixation of Minimum Indicative Prices (MIP) of tobacco.
v. Fixation of grades for quality control of tobacco.
vi. Tripartite meetings with growers, dealers and tobacco companies to discuss and resolve the issue.
vii. Announcement of dates for commencement of purchase of tobacco.
viii. Supervision of Marketing during tobacco purchase season.
ix. Constitution of Vigilance Committee.
x. Request Secretary, Agriculture, Livestock & Cooperation Department for Constitution of Governor Inspection Team (GIT).

Calendar year activities performed by marketing section of PTB are as under:

Calendar Year Activities (Marketing Section)

No	Activity	Month
1	Fixation of MIPs	September/October
2	Requirement submission	31st October
3	Announcement of requirement	November
4	Execution of agreements with Farmers	31st day of December
5	Agreement list submission to PTB	15th January
6	Agreement Verification	February/March

7	Intimation regarding purchase points	31st May
8	Vigilance committees and Governor Inspection Teams constitution	June
9	Tripartite meeting	June
10	Commencement of date for purchase	June
11	Purchase of Tobacco	July/August/September

MINIMUM INDICATIVE PRICES FOR THE LAST FIVE YEARS

S.No	Year	FCV		DAC	WP	Burley
		Plain	Sub-Mountainous			
1	2019	190.63	218.77	94.76	82.85	150.54
2	2020	203.50	233.52	101.14	88.43	160.69
3	2021	214.75	243.67	108.09	123.01	187.50
4	2022	245	281.13	149.09	123	187.50
5	2023	310	351	190	146	223

EXPORT OF TOBACCO AND TOBACCO PRODUCTS

Year	Quantity exported			Values realized			Total value (M.US$)	Total value (M.Rs.)
	Tobacco (M.Kg)	Cigarettes (M.Sticks)	Cigars (M.Sticks)	Tobacco (M.Rs.)	Cigarettes (M.Rs.)	Cigars(M.Rs.)		
2018-19	9.71	1.81	-	3335.86	3.79	-	25.973	3339.67
2019-20	12.8	510.5	2.07	5620.56	1077.45	4.346	43.552	6702.36
2020-21	15.49	2243	-	5916	2258	-	52.05	8174
2021-22	22.39	1737	-	13054	2412	-	77.34	15466
2022-23	31.99	1552		16149	2537		81.54	18686

Source: Federal Board of Revenue

Finance & Accounts

Statement of income and expenditure of Pakistan Tobacco Board during the periods is as given below

(Rs. Millions)

Period	Income Rs	Expenditure Rs	Surplus/Deficit Rs	% Increase/Decrease
FY 2018-19	475.9	286.9	188.9	53.68%
FY 2019-20	524.1	320.7	203.3	7.6%
FY 2020-21	530.2	324.5	205.5	1.8%
FY 2021-22	590.9	371.6	219.3	11.45%
FY 2022-23	524.3	693.2	(168.8)	(32%)

Source: Pakistan Tobacco Board

CESS AUCTION BY PTB FROM 2021-22 AND 2022-23

Year	Khyber Pakhtunkhwa	Punjab	Baluchistan	Total	Increase
2021-22	**Rs.136,000,000/-**	**Rs.66,000,000/-**	**Rs.14,200,000/**	**Rs.216,200,000/**	**12.17%**
2022-23	**Rs.158,000,000/-**	**Rs.70,001,000/-**	**Rs.14,500,000/**	**Rs.242,501,000/**	

ACHIEVEMENTS

1) Several meetings between representatives of tobacco companies, representatives of tobacco growers, dealers & Board Members regarding Cost of Production were held in PTB Head office Peshawar. The results were shared with the Ministry of National Food Security & Research and on the basis of meeting's results, MIP was finalized by the Federal Government on December 22, 2022 for tobacco crop 2023.
2) Announced yearly requirements of Tobacco Companies/Dealers in daily newspapers on December 14, 2022.
3) Distributed Rs. 4,870,000/- from Spilled over Leaves (SOL) fund of Swabi, Mardan, Charsadda, Buner and Mansehra to 201 tobacco growers affected due to burning of their Barns after proper verification.
4) Verification process to evaluate genuineness of agreements was performed by 11 committees constituted by PTB.
5) Requested Secretary, Agriculture, Livestock & Cooperation Department for Constitution of Governor Inspection Teams.
6) Letter sent to DC Mansehra and Buner for imposition of section 144 on June 19, 2023.
7) Separate meetings with Tobacco Companies, Dealers and Growers for identification of marketing problems for tobacco crop 2023.
8) Tripartite meeting on June 21, 2023 to solve the sorted issues.
9) Constituted 107 Vigilance Committees on June 16, 2023 for supervision of tobacco purchase season 2023.
10) Announced early date for commencement of purchase w.e.f. 19th June 2023.

19. SPACE AND UPPER ATMOSPHERE RESEARCH COMMISSION (SUPARCO)

Performance of SUPARCO during the Financial Year (2022-23)

1. Satellite Remote Sensing plays a vital role in mapping and monitoring of agricultural resources. Remote sensing technology with its capability to repetitively acquire synoptic images can be employed to classify various types of crops, estimate crop area, monitor crop health/crop growth and assist in crop production and yield estimation. Satellite derived information coupled with field validation provide reliable geospatial information on comparative crop production situation well in advance of crop harvest. Moreover, in case of natural, calamities, damages to crop can be easily assessed.

   Timely, frequent and accurate information on crop situation forms the basis of reliable food security policy. The need of reliable and timely information on area and production of major/minor crops and improvement in existing agricultural data collection system in the country is imperative. Ministry of National Food Security & Research (MNFS&R) approved SUPARCO's project, "Geospatial Monitoring of Major and High value Crops" in September, 2020 at a cost of Rs. 129.609 Million for 03 years. The main objectives of this project are:

   a. Satellite based system development for estimation of crop area, yield and production of major seasonal crops i.e. Wheat, Rice, Sugarcane, Cotton and Maize
   b. R&D for satellite based estimation of minor and high value crops such as Mungbean, Chilies, Rapeseed Mustard, Banana, Mango and Citrus
   c. Capacity building of Provincial Crop Reporting Services (CRSs) through:
      - Organizing training courses on application of satellite technology in crop estimations
      - Strengthening of nucleus labs through provision of hardware/software
   d. Sharing of satellite based information on crops

   Under this project, keeping in view crop calendar of various crops in different cropping zones, SUPARCO acquires multi-resolution, multi-date satellite images for complete coverage of the country. Field validation surveys are carried out in different cropping zones for collection of spectral signatures. Besides, satellite derived products/indices, information on agro-met

conditions (rainfall, humidity, sunshine, etc) and crop inputs (fertilizer, irrigation water supply, etc) are also acquired from allied departments.

Using geospatial techniques and ground based information, a series of temporal satellite images are processed for extraction of crop layers (spatial information and area estimation. Crop yield forecasting is carried out using crop health indices, agro-met parameters and crop inputs. In case of any natural calamity, satellite based crop damage assessment is also carried out and the same is incorporated in final crop estimates.

2. Progress of the Project:

Component-wise progress of the project for financial year 2022-23 is as follows:

a) Satellite based Estimation of Major Crops

Using satellite based crop monitoring system, SUPARCO worked out crop estimations for Kharif (2022-23) and Rabi (2022-29). These estimates were presented in meetings of Federal Committee on Agriculture (FCA) held during October, 2022 and April, 2022 and shared with Economic wing of MNFS&R. The province-wise estimates and maps showing country-wide spatial distribution of crops are as follows:

Sugarcane (2022-23)

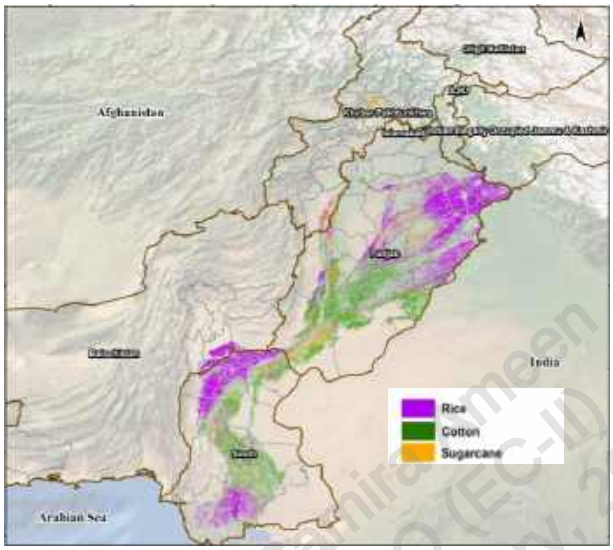
SUPARCO Sugarcane Crop Estimates: 2022-23			
Province	Area	Yield	Production
	000 ha	Tons/ha	000 Tons
Punjab	828.3	68.7	56928.7
Sindh	295.0	60.5	17848.3
Khyber Pakhtunkhwa	103.1	57.3	5904.8
Pakistan	**1226.4**	**65.8**	**80681.7**

Cotton (2022-23)

SUPARCO Cotton Crop Estimates: 2022-23			
Province	Area	Yield	Production
	000 ha	Kg/ha	000 Bales
Punjab	1412.3	597	4961.9
Sindh	706.8	419	1739.9
Balochistan	26.7	467	73.3
Pakistan	**2145.8**	**537**	**6775.1**

Rice (2020-21)

SUPARCO Rice Estimates: 2022-23			
Province	Area	Yield	Production
	000 ha	Kg/ha	000 Tons
Punjab	2244.8	2130	4782.0
Sindh	1250.1	3051	3814.4
Khyber Pakhtunkhwa	54.0	2619	141.5
Balochistan	181.0	2915	527.6
Pakistan	**3729.9**	**2484**	**9265.5**

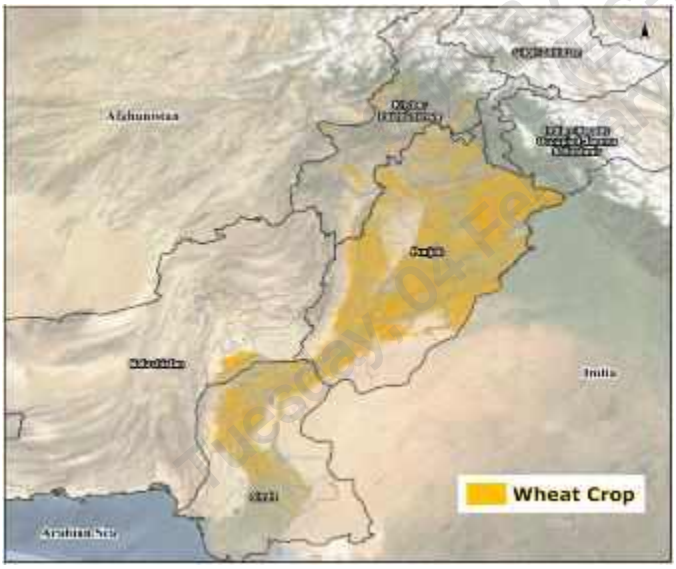


Assessment of Damages due to Rains/Floods (July-August,2022)

SUPARCO carried out satellite based rapid crop damage assessment and worked out inundated area of major Kharif crops cotton, sugarcane, rice and other crops. Extent of damages for these crops was dependent upon intensity of flood (depth, velocity, duration) and crop physiology. The damages to crops were incorporated in final estimates.

Wheat (2022-23)

SUPARCO Wheat Estimates: 2022-23			
Province	**Area**	**Yield**	**Production**
	000 ha	**Kg/ha**	**000 Tons**
Punjab	6,177.9	3028	18,705.1
Sindh	1,436.6	3005	4,316.7
Khyber Pakhtunkhwa	724.7	1843	1,335.7
Balochistan	401.7	2524	1,014.1
Pakistan	**8741.0**	**2903**	**25,371.5**



a) <u>Assessment of Damage due to Rains/Hailstorms (March, 2023)</u>

SUPARCO analyzed the affected areas of Wheat using satellite imagery. It was estimated that an area of 1368.63 thousand hectares of Wheat was affected by rains/hailstorms causing an anticipated production loss of 372.61 thousand tons. Production loss was incorporated in final estimates.

b) Publishing of Monthly Bulletin: SUPARCO under satellite based crops monitoring activity, publishes monthly crop situation bulletin on regular basis. This bulletin covers: crop situation for the respective month, agro-meteorological condition, availability of irrigation water supply, fertilizer condition, recommendations for farmers and damage assessment to crops due to any natural calamity (if any).

PAK-SCMS

BULLETIN

PAKISTAN: SATELLITE BASED CROP MONITORING SYSTEM

Volume XIII, Issue 7, Serial No. 151 1-July 2023

SUPARCO

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CROP SITUATION: JUNE 2023

Summary

By the end of June 2023, the Satellite based Normalized Difference vegetation Index (NDVI) values show start of Kharif season crops. Generally, below normal temperatures were observed in most parts of agricultural plains of the country. However, it remained above normal over the northern belt of Kashmir, Gilgit Baltistan and northwestern areas of Balochistan. During June 2023, above normal rains reported from most parts of the country except Gilgit Baltistan, northern parts of Baluchistan & Khyber Pakhtunkhwa, western Balochistan and few parts of central Punjab.

Federal Committee on Agriculture in its meeting held on 12th April 2023 fixed Kharif crops targets. Cotton crop production target of 12.77 million bales was fixed from an area of 2767.0 thousand hectares with an average yield of 784.79 Kg per ha. Similarly rice crop production target of 9.041 million tons was fixed from an area of 3009.90 thousand hectares with an average yield of 2943.9 Kg per ha. Sugarcane production target of 78.586 million tons is fixed from an area of 1181.90 thousand hectares with an average yield of 66.49 tons per hectare.

Cotton crop sowing has been completed during the month in Punjab and Sindh and at various growth stages from germination to boll formation depending on sowing time. Generally insect pests were under control by end of June especially white fly and CLCV incidences were less than last year. However sporadic attack of Jassids and thrips were reported.

In local market, average ex-gin cotton price during June 2023 decreased by about 0.5 percent compared to June 2022. Approximate average ex-gin price during June 2023 was Rs. 21800.4 per 40 kg against Rs. 22200.7 during June 2022 showing a decrease of Rs. 1360.3 per 40 kg.

Sugarcane crop growth was generally satisfactory and insect pest situation was also under control by end of month.

Early transplanted coarse rice was at vegetative stage. Further, nursery sowing

Pakistan Satellite based Crop Monitoring System Bulletin is a joint monthly publication of SUPARCO and FAO, UN.

3. <u>Activities to be undertaken in the fiscal year 2023-24</u>

The project has been closed by 30th June, 2023.

Government of Pakistan
Ministry of National Food Security and Research
(Economic Wing)
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EDITORIAL BOARD