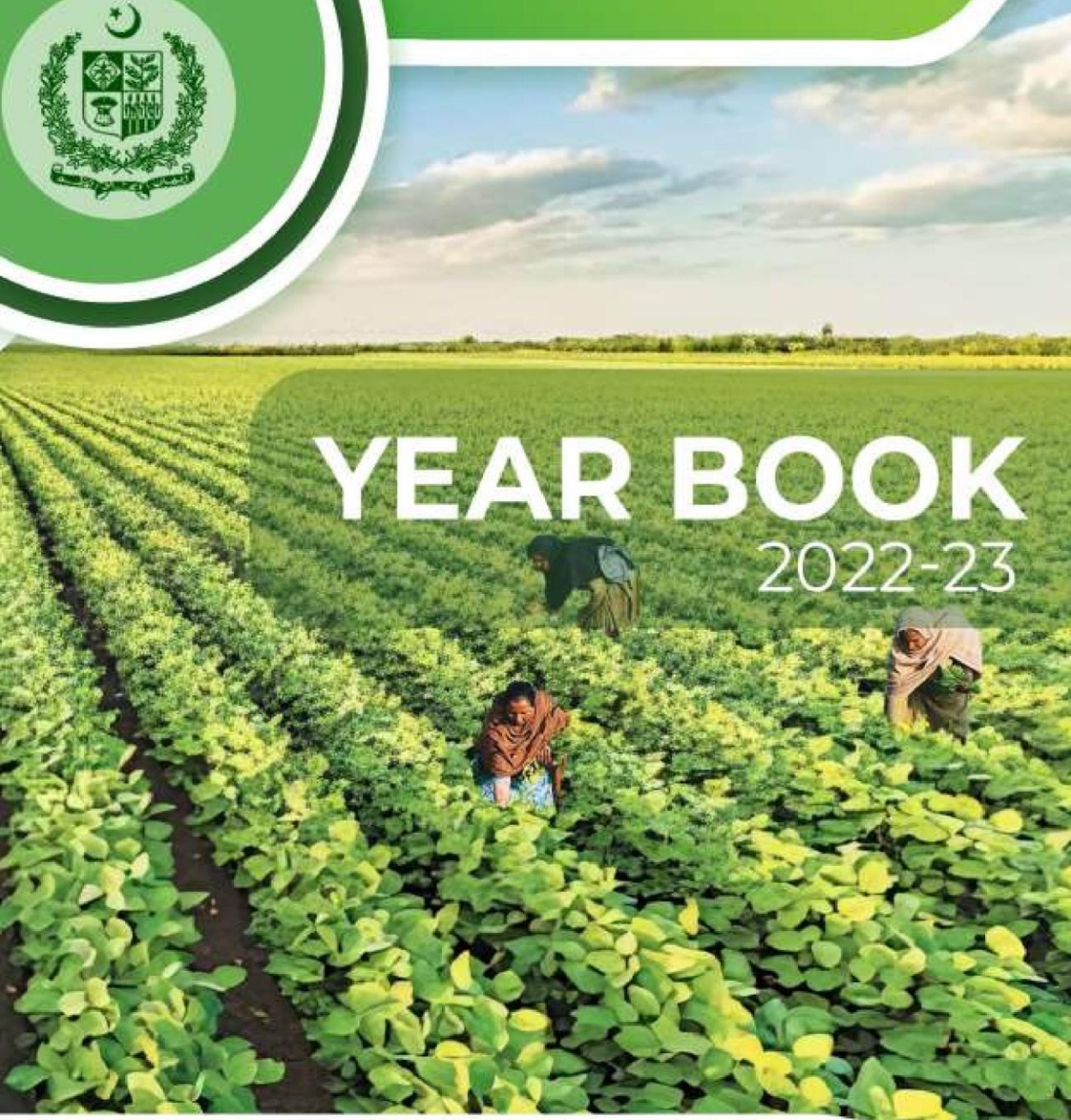

YEAR BOOK
2022-23

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

www.mnfsr.gov.pk

Message

Agriculture plays a central role in food security, poverty reduction and national growth,. Its contribution in GDP is 22.9 percent and 37.4 percent of total labor force of the country is employed in agriculture sector. Pakistan is selfsufficient in production of staple foods, livestock and dairy, however, economic access and utilization persist as the major limiting factors for household-level food and nutrition security. Addressing these challenges has been identified as an area of prime focus by the Government. The growth in agriculture not only results in enhanced supply of raw material to agro-based industries like textile, sugar, food processing but also generates demand for industrial goods and services. The better performance of agriculture is due to various measures of Government to enhance agricultural products like support price for production, significant increase in credits, better arrangements for the provision of inputs like seeds, fertilizers, insecticides and better arrangements for marketing.

2. Present Government has accorded high priority to the development of agriculture to play a vital role in boosting national economy and ensuring food and nutritional security. The emphasis is also given to agriculture, livestock, research and development priorities with a focus on nutrient dense foods such as fruits, vegetables, legumes and animal source foods.

3. The year book 2022-23 describes comprehensive programes and activities performed by various wings and attached departments of Ministry of NFS&R during the year to achieve the targets and objectives of the Ministry of National Food Security & Research.

Dr. Kauser Abdullah Malik
Minister for National Food Security and Research (NFS&R)

November, 2023

FOREWARD

The **Year Book 2022-23** 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 2022-23 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.

3. Comments and suggestions for improvement of the year book would be highly appreciated.

(Captain (Retd) Muhammad Mahmood)
Secretary
Ministry of National Food Security and Research (NFS&R)

November, 2023

Government of Pakistan
Ministry of National Food Security and Research
(Economic Wing)
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EDITORIAL BOARD

Contents

INTRODUCTION

The agriculture sector serves as the backbone of Pakistan's economy and **provides the inputs to Pakistan's ailing 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 landscape. Pakistan's economy recorded a modest growth in FY23, after going through Covid and heavy flood 2022.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 continued to perform well and contributed the growth more than half of in agriculture value addition.

Global Economy is facing highest-ever inflation due to strong consumer demand, persistent supply disruptions, and surging commodity prices. Despite of RussiaUkraine war, the ever-worsening impacts of climate change, the long-reaching aftereffects of the COVID-19 pandemic, the escalating monetary tightening, and growing policy challenges - have driven many countries perilously close to crisis. Meanwhile, in Pakistan's case the primary challenges currently facing the agricultural sector include water scarcity combined with too many mouths to feed, lack of crop diversity, ineffective land management, traditional farming practices and processes, insufficient marketing tools, uneven access to credit facilities, poorly adapted crop-related inputs and low literacy among populations of farming communities. The prevalent utilization of traditional resources results in synthetic inputs and pesticides further exacerbate the situation by prompting excessive environmental and health effects attributed to their use.

After heavy monsoon spell in July-August 2022, **Kissan Pacakage -2022** worth Rs. 571 billion has been has initiated and several measures have been taken to support and promote the farmers and agriculture sector in the country. These measures include financial assistance, infrastructure development, subsidy on electricity, and the provision of agriculture machinery and inputs. Promoting the agriculture sector and farmers, particularly in flood-hit areas free seeds, intrest free loans and bringing down prices of fertilizers and electricity for tubewells as well.

To keep pace with the situation, the government with all possible measures, looks forward to encouraging the farmers in Pakistan to produce enough to meet the domestic demands and export their surplus. Improving the food and activities sector has received enough attention of the state, the private sector and donors. 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. **Food Securtiy Policy 2018** aims at boosting the agricultural sector, limited resources being allocated to research and extension activities, at the central, provincial and local levels, coordination efforts may be successful in enabling farmers' access to subsidized inputs and other essential services needed to enhance production and marketing.

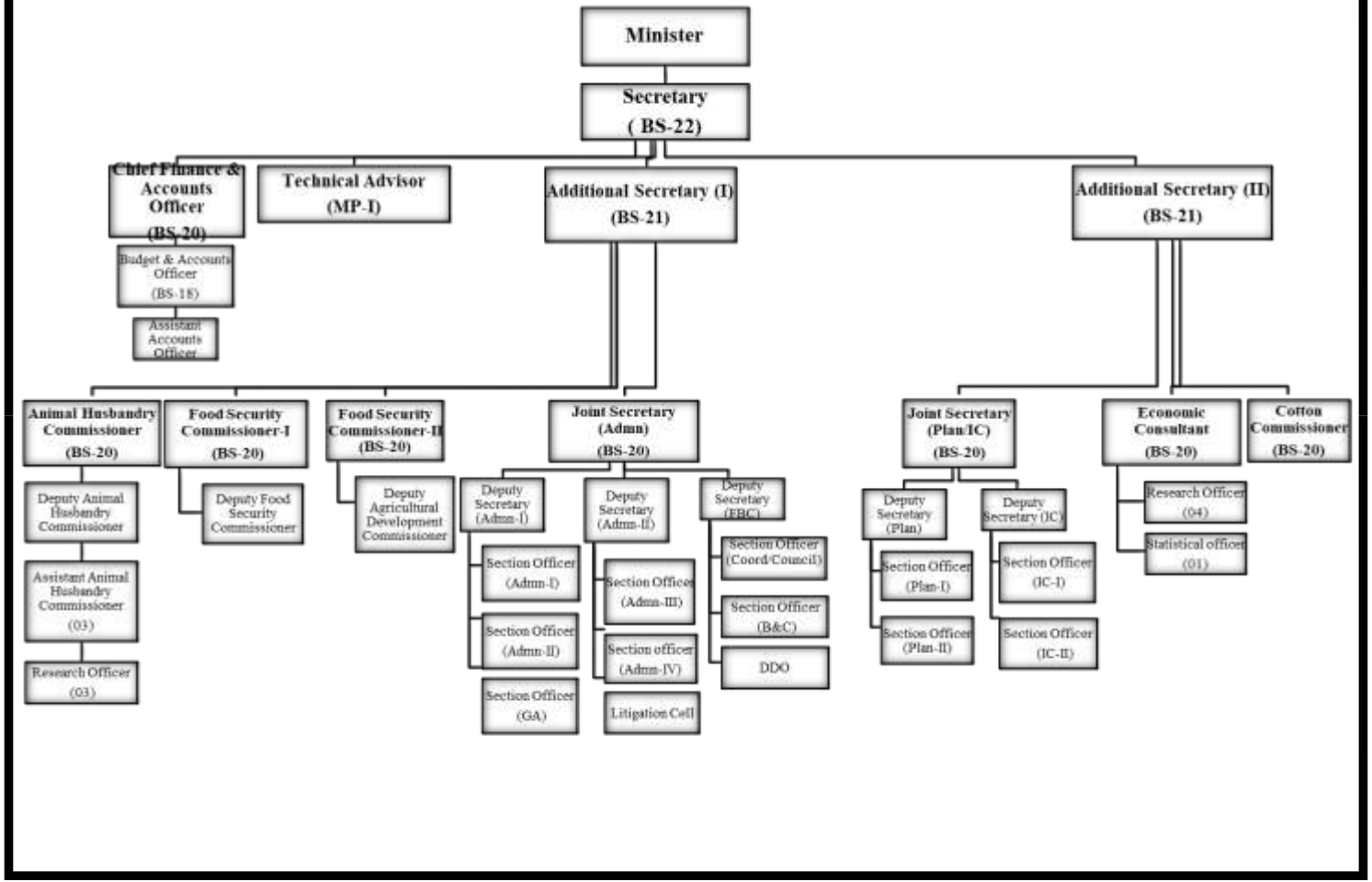
OVERVIEW

The Ministry of National Food Security and Research (NFS&R) through its attached departments, autonomous organization and boards is focusing to ensure food security. Links between agriculture and food security have long been recognized and there is 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 interprovincial 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 interprovincial 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.


Minister
Secretary
(BS-22)
Chief Finance & Accounts Officer (BS-20)
Budget & Accounts Officer (BS-18)
Assistant Accounts Officer
Technical Advisor (MP-I)
Additional Secretary (I) (BS-21)
Additional Secretary (II) (BS-21)
Animal Husbandry Commissioner (BS-20)
Deputy Animal Husbandry Commissioner
Assistant Animal Husbandry Commissioner (03)
Research Officer (03)
Food Security Commissioner-I (BS-20)
Deputy Food Security Commissioner
Food Security Commissioner-II (BS-20)
Deputy Agricultural Development Commissioner
Joint Secretary (Admn) (BS-20)
Deputy Secretary (Admn-I)
Section Officer (Admn-I)
Section Officer (Admn-II)
Section Officer (GA)
Deputy Secretary (Admn-II)
Section Officer (Admn-III)
Section officer (Admn-IV)
Litigation Cell
Deputy Secretary (FBC)
Section Officer (Coord/Council)
Section Officer (B&C)
DDO
Joint Secretary (Plan/IC) (BS-20)
Deputy Secretary (Plan)
Section Officer (Plan-I)
Section Officer (Plan-II)
Deputy Secretary (IC)
Section Officer (IC-I)
Section Officer (IC-II)
Economic Consultant (BS-20)
Research Officer (04)
Statistical officer (01)
Cotton Commissioner (BS-20)

PART-I
Performance of M/o NFS&R

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 AdmnIII & 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
	SO (Plan)2	• Coordinating activities pertaining to National Coordination Committee
		(NCC) on Agriculture 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. 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 development activities with regard to Food Security through public sector development program(PSDP).This Wing analyses the project proposals /PC-1's initiated by the line Developments of the Ministry and processes those for approval of the competent forums such as DDWP,CDWP and ECNES 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 submits monthly and annual progress reports to planning commission and Finance Division.

Funds to the tune of Rs.10,129.134 million were allocated in PSDP 2022-23 for execution of the following development projects under this Ministry:-

- Better cotton initiatives
- Cage Culture Cluster Development Project
- Calf Feedlot fattening in Pakistan
- Commercialization of Potato Tissue culture Technology in Pakistan
- Construction of Office & Laboratory Building of Animal Quarantine Department ,Karachi
- Cotton productivity Enhancement through eco-friendly pink bollworm management and capacity building in Punjab under PM Emergency Program
- Establishment of consumer-sourcing seed authenticity system and strengthening of Labs of FSC&RD
- Establishment of plant Breeders Rights Registry and Strengthening of DUS examination system
- Establishment of Seed Certification services in Southern Balochistan
- Geospatial monitoring of Major and high value Crops
- National Oilseed Enhancement program
- National peste Des Petits Ruminants (PPR) Eradication Programme,Phase 1-Risk based PPR control in sheep and Goats of Pakistan
- National Program for enhancing the command Area in Barani Areas of Pakistan
- National Program for Improvement of watercourses in Pakistan –phase – II

- Pilot shrimp Farming Cluster Development
- Prime Minister's Initiative for Backyard Poultry
- Prime Minister's Initiative for Save the Calf
- Productivity Enhancement of Rice
- Productivity Enhancement of sugarcane
- Productivity Enhancement of Wheat
- Promoting Research for Productivity enhancement in Pulses
- Promotion of Olive cultivation on commercial scale in Pakistan –Phase - II
- Promotion of Trout Farming in northern Areas of Pakistan
- Sino-Pak Agricultural Breeding innovations project for Rapid Yield enhancement
- Strengthening /Up-gradation of Agriculture and Livestock Research System of Arid Zone Research Institute ,Umerkot -Sindh
- Strengthening of Monitoring and Evaluation Cell in M/o NFSR.
- Updating of Agro Ecological Zones of Pakistan through Satellite and in – Situ-Data Mapping
- Upgradation and Establishment of Animal Quarantine Stations in Pakistan Phase –II
- Water Conservation in Barani Areas of KP
- Locaust Emergency and food Security Project
- Mainstreaming of Mountain Agriculture Research Centre (MARC) for the promotion of high value agriculture in Gilgit Baltistan
- National Program for Animal Disease Surveillance (PC-II)
- Quality seed production and supply to the farming community for ensuring food security in Pakistan(revised)

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:-

1. **Agricultural Statistics of Pakistan 2021-22**

The Wing released and uploaded the publication on Ministry's website. The next publication 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

2. **Fruit, Vegetables & Condiments Statistics of Pakistan 2021-22**

The Wing released and uploaded the publication on Ministry's website "Fruit, Vegetables and Condiments Statistics of Pakistan 2016-17" containing province-wise data for the year 2012-13 to 2016-17. 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 in process.

3. Crops Area and Production (By Districts) 2021-22

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 in process.

4. Year Book of the Ministry 2021-22

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 the 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.

Performance of Essential Agriculture Food Commodities (EAFC) Cell

1) 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 (Annexed). 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) Daily 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 has established a separate IT cell, which is working on the further development of the portal.

At present the CELL is also serving as a secretariat to the Prime Minister Taskforce on agriculture and KISSAN Package.

2) Food Security Dashboard

Pakistan is undergoing structural adjustments. At the heart of the adjustments is liberalization of markets and prices, including freeing the currency market, reducing industrial protection, and introducing financial austerity and macroeconomic stability. The agricultural sector is also undergoing these changes. Variations in the prices of agricultural outputs and inputs affect income distribution, both within the agriculture sector and between the agricultural sector and the non-agricultural

sectors. Pricing policies of the government and the local and international trade environment have a major impact on profitability in the agricultural sector. Thus, changes in agricultural commodity prices affect living standards, employment, incomes, and poverty levels in the rural areas. An increase in the producer prices increases profitability and improves the standard of living of the people depending on crop income, and vice versa, keeping fixed other factors such as the quantity of goods. At present, data is being generated but the frequency of data collection and dissemination is very low and does not cater to the erstwhile need for policy response. There are also deficiencies in integrated, forward-looking analytical products on Food Security to support sound policy development. In addition, the various analytical products that do exist are often produced by International Organizations and tend to focus on acute food insecurity emergencies that are useful for early warning and in informing emergency responses, though less useful for longer term policy planning and development. Analytical products by National and Province level institutions tend to be sector specific and often do not integrate cross-sectoral information and thereby offer only a limited view of food security. These analytical products are also often poorly disseminated, thereby reducing their effectiveness, or simply are not fully recognized by data users. For example, ongoing monthly statistics on crops and crop yield forecasts produced using satellite imagery by SUPARCO, the National space agency, are not fully recognized by important users such as the National Accounts Committee and Federal Committee on Agriculture.

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 evidenced 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.

Trainings were conducted as per dates below:

- Sindh Province from May 30, 2023, to June 1, 2023
- KP Province took place from June 06, 2023, to June 08, 2023
- Punjab Province, PASSCO, and AMIS from June 13, 2023, to June 15, 2023
- with Balochistan province on June 20, 2023, to June 22, 2023

- **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. Furthermore, dashboard on fertilizer, seeds is partially operationalized and reports on daily, weekly, and monthly basis are prepared and coordinated with the Prime Minister Office and attached departments for policy intervention.

- **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

FOOD SECURITY COMMISSIONER – I (TECHNICAL WING)

The technical wing of M/o NFS&R designated as Food Security Commissioner-I is comprised of the Food Security Commissioner-I (FSC-I) and Deputy Food Security Commissioner-I (DFSC-I). This wing has been assigned to perform following functions;

1. Professional and technical aspects in the formulation of action programs and policies for high value food crops to ensure food security.
2. Production, price trends and marketing of high value crops as well as the problems faced by the food producers and processors in the chain from production to trade for high value crops.
3. Maintain coordination and liaison with Agricultural Research Institute and extension services at Federal and Provincial level to find out its effectiveness in ensuring the National Food Security focusing high value crops.
4. Formulation of development strategy and prices support policies concerning 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 and other assigned jobs.
7. To provide all technical assistance to various wings of M/o NFS&R.
8. Any other duties assigned by the competent authority.

Achievements

1. National Oilseed Policy drafted and under submission for approval.

2. Much legislation were proposed for pesticides regulation and made new rules for pesticides in the country.
3. National Action Plan on Seed and Fertilizer distribution during flood at NFRCC.
4. National Plan for Agriculture Yield Improvement as finalized by the committee is submitted for kind consideration of the Prime Minister of Pakistan.
5. The meeting of Federal Committee on Agriculture for Rabi 2022-23 and Kharif 2023-2024 were convened in time to harness the opportunity created for a better Rabi and Kharif crops by the Technical Wing of (FSC-I).
6. All quarantine and pesticides matter of the country are duly addressing by the Technical Wing of Ministry though monitoring and advising to the attached departments.
7. During 2022-23 the record production of Rice, Maize, Potato, Mung and Sugarcane and record export of agro products remained significantly higher as compared to last year. The export data tabulated on the basis of phytosanitary certificate indicate that Pakistan exported the largest quantity of Kinnow, Mango and potato in its history without any interceptions as compared to last year.
8. Regular meetings of Agriculture Pesticide Advisory Committee (APTAC) and Sub APTAC were convened and a number of issues were resolved.
9. Single Window successfully launched (DPP, FSC&RD, PTB and AQD)
10. All the writ petition filed in different courts were addressed and won by the Government.
11. The Technical Wing is giving full assistance and consultation to POD, Water Management Cell, PARC, PTB and DPP.

FOOD SECURITY COMMISSIONER – II

FSC-II wing deals with the 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 2022-23, wheat was cultivated on 9,043 thousand hectares against last year's area of 8,977 thousand hectares recorded increase of 0.7 percent. Wheat contributes 8.2 percent value added in agriculture and 1.9 percent to GDP. The production of wheat stood at 28.13 million tons compared to 26.208 million tons last year, a growth of 5.4 was

observed in wheat production. Wheat production increased as government has announced Kissan Package-22 to mitigate the impact of Flood2022 losses. The government has also increased Minimum Support Price (MSP) to Rs 3900/40 kg compared to Rs 2200/40 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 tomeet 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 18thAmendments 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 09-03-2023, fixed Profitable support price of wheat crop 2022-23 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 are given below:

Production Year	**Support Price (Rs. /- 40 Kg)**
2008- 09	950
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	2,200
2022-23	3,900*

*Sindh had announced a unilateral support price of wheat at Rs. 4,000/40 Kg.

Benefits of Support Price

1. Profitability for growers, so that growers do not switch to other alternative crops.
2. Takes 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 2022-23

High Powered Federal Committee on Agriculture (FCA) in its meeting held on 13thOctober, 2020 fixed wheat production target at the tune of 28.37 million tons from an area of 9.25 million hectares as given below:

Province / Crop	**Targets Proposed by FCA 2022-23**		
	Area (000 ha)	**Production (000 MT)**	**Yield (Kg/ha)**
WHEAT			
Punjab	6670	21000	3148.4
Sindh	1130	4000	3539.8
Khyber Pakhtunkhwa	900	1800	2000.0
Balochistan	550	1570	2854.5

Pakistan	**9250**	**28370**	**3067.0**

Production v/s Acheivements for Wheat Crop 2022-23

Province	Target 2022-23		Achievements 2022-23	
	Area (000 Hec)	**Production (MMT)**	**Area (000 Hec)**	**Production (MMT)**
Punjab	6670	21.00	6479	21.23
Sindh	1130	4.000	1194	3.89
Khyber Pakhtunkhwa	900	1.800	781	1.49
Balochistan	550	1.570	542	1.52
Pakistan	**9250**	**28.370**	**8996**	**28.13**

Source: Provincial Crop Reporting Services (CRS).

Wheat Availability for 2023-24

Overall availability of wheat is estimated at the level of 29.76MMT, including carry-forward stock of 1.63 MMT and production of 28.13 MMT as compared to the national requirement of 32.85 MMT. Details are given below:

Production (MMT)	Carryforward Stocks (MMT)	Availability (MMT)	Requirement (MMT)	Estimated Shortfall (MMT)
28.13	**1.63**	**29.76**	**32.85***	**3.09**

* 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	127,680,000	14.68
Sindh	55,690,000	6.40
Khyber Pakhtunkhwa	40,850,000	4.70
Balochistan	14,890,000	1.71
FATA	5,620,315	0.65
Islamabad	2,360,000	0.27
AJK	4,884,129	0.56
GB	1,725,033	0.20
IDP's	1,558,765	0.18
Human Consumption **	**255,258,242**	**29.35**
Seed, Feed and Wastages***	-	1.50
Strategic Reserves	-	2.00
Grand Total		**32.85**

- * Based on PBS 7th population Census 2023, notified on 05-08-2023 in the 50th meeting of the Council of Common Interests.
- ** Human consumption is estimated @115kg/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.

Import of Milling Wheat

Since last 3 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 through PASSCO under G2G arrangements.
2021-22	2.201	0	2.201	TCP, through international tendering process.
2022-23	2.600	0	2.600	Through TCP, 0.750 under G2G arrangements.

Source: TCP.

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 27-07-2023 with the following recommendations:

> "In order to maintain strategic reserves of PASSCO, Trading Corporation of Pakistan (TCP) may be allowed to import 1.00 MMT of specified milling wheat, in the first phase. The import of wheat may be made either through G2G arrangements or through open tendering process, whichever is the most economical, as per Notification of 2008, issued by MinFA to maintain strategic reserves in the country".

The ECC of the Cabinet considered the above Summary on 7th and 8th August, 2023 and deferred its consideration.

PASSCO has reported wheat stock at the level of 2.059 MMT as on15-082023. In compliance with the decision of the ECC of the Cabinet taken in its meeting held on 24-07-2023, a further quantity of 1.701 MMT would be supplied among recipients up to 01-04-2024. Therefore, PASSCO would be left with the carry-forward stock of 0.358 MMT at the end of Food Year and will need a further quantity of 1.642 MMT to reach the allocation of 2.0 MMT of strategic reserves.

Wheat Stock Position with PASSCO as on 15-08-2023

ITEM	WHEAT STOCK (MT)
AVAILABILITY	
Carry-forward Stock 2022	1,339,939
Procurement- 2023	1,130,788

Imported Wheat 2022-23	375,589
Climatic Moisture	6
TOTAL AVAILABILITY	**2,846,322**
Stock Released so far as on 15-08-2023	786,796
Stock to be released	1,701,204
Total Releases up to 01-04-2024	**2,488,000**
Expected Carry-forward Stock as on 01-04-2024	**358,322**

WHEAT ALLOCATION AMONG RECIPIENTS FOR 2023-24

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	1,400,000
04.	Gilgit Baltistan	200,000
05.	Azad Jammu & Kashmir (AJ&K)	300,000
06.	Utility Stores Corporation	400,000
	Grand Total:	**2,488,000***

*ECC of the Cabinet approved the allocation in its meeting held on 24-07-2023 and the ECC decision was ratified by the Federal Cabinet on 26-07-2023. Source: MNFS&R, PASSCO.

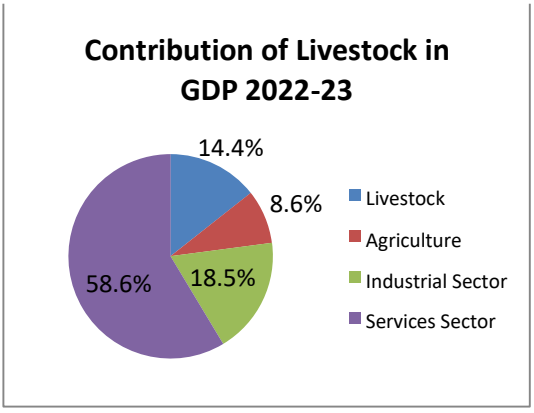
Pakistan Bureau of Statics (PBS) on 10-08-2023 has reported wheat flour price at Rs.2,830.23/20 Kg bag, whereas, wheat prices are reported atRs. 4,938.56/40 Kg. International Grains Council on 16-08-2023 has reported price of Black Sea wheat at US$ 247/MT (FOB). With addition of freight charges of US$ 40/MT and 6% Withholding Tax (US$15/MT) and US dollar exchange rate of Rs. 300, the CFR price of wheat at Karachi is estimated to be Rs. 3,624/40 Kg or Rs. 90,600/MT. For sustainability in demand and supply and equilibrium in wheat prices, import of 1.00 MMT of milling wheat, at first phase is proposed, in order to maintain strategic reserves with PASSCO.

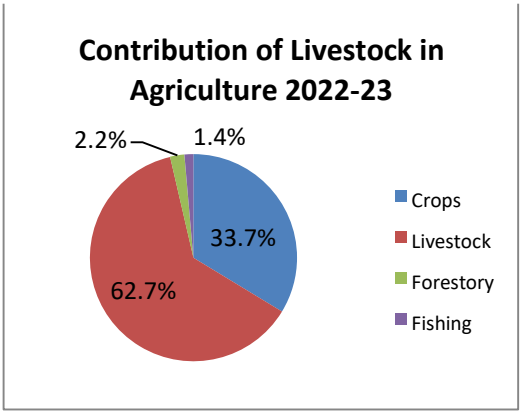
5. LIVESTOCK WING

LIVESTOCK AND POULTRY

LIVESTOCK

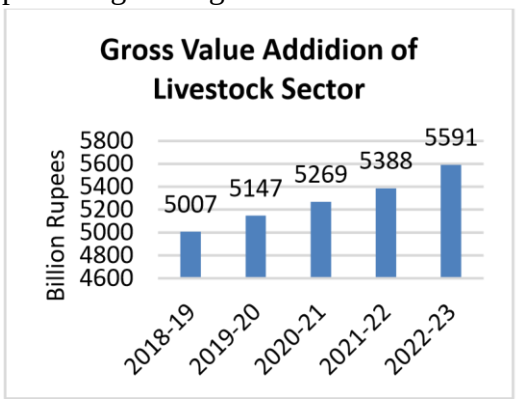
Animal husbandry plays a pivotal role in Pakistan's rural economy, with more than 8 million rural families actively involved in livestock production. They rely on this sector for a significant portion, approximately 35-40%, of their income. Notably, the livestock sector has taken the lead as the most substantial contributor to agriculture, representing about 62.7% of the agriculture value added and contributing 14.4% to the national GDP during the 2022-23 fiscal year, as illustrated in the graphs below: -

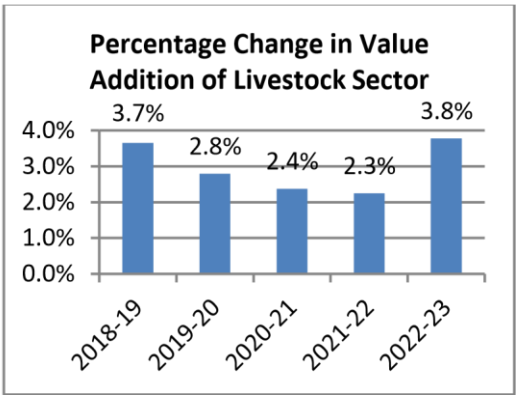




Source: Economic Survey of Pakistan

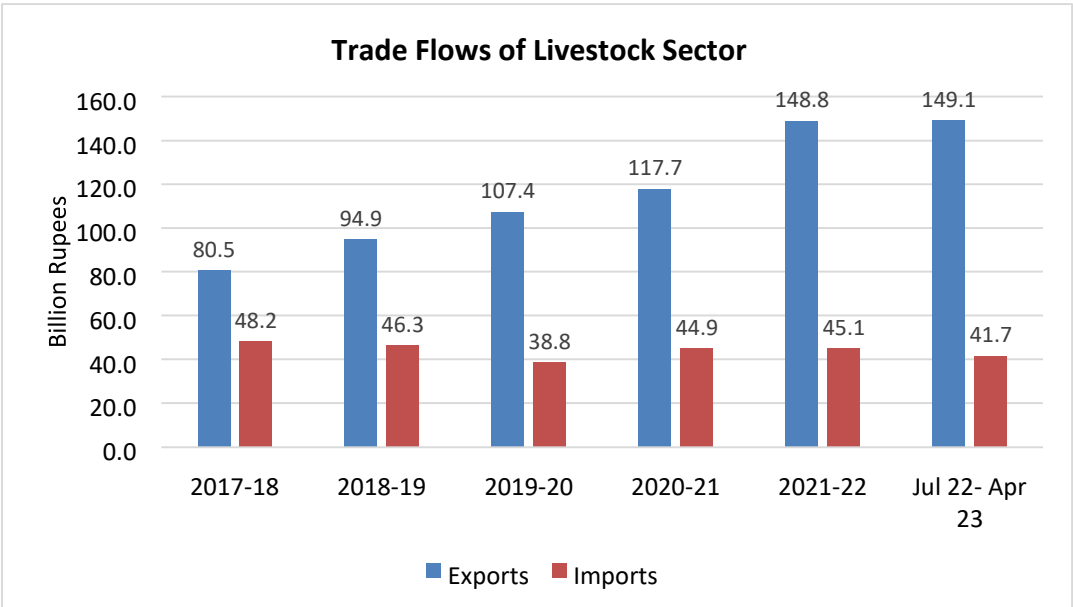
The gross value addition of livestock in Pakistan has shown a steady increase, rising from Rs. 5,388 billion in 2021-22 to Rs. 5,391 billion in 2022-23, reflecting a notable growth of 3.8%. The graph below provides a clear illustration of the livestock sector's gross value addition over the past five years along with percentage changes.





Source: Economic Survey of Pakistan

The graph below presents the trade flows of the livestock sector, displaying a steady and consistent rise in exports. Pakistan enjoys a favorable balance of trade, with the livestock sector playing a significant role in contributing approximately 2.1% to the country's net foreign exchange earnings.



Source: Pakistan Bureau of Statistics

During the period from Jul 2022 to Apr 2023, the major exports from the livestock sector included meat and meat products valued at 69.9 billion rupees, tanned hides and skins valued at 29.7 billion rupees, animal feed valued at 24.1 billion rupees, and animal products valued at 18.2 billion rupees. Similarly, the major imports comprised animal feed worth 17.9 billion rupees and dairy and dairy products worth 13.3 billion rupees.

This reflects the inherent potential of livestock sector for generating economic activity and employment besides supplementing high value animal origin protein for human consumption. The government has recognized the 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, artificial insemination services, use of balanced ration for animal

feeding, and controlling livestock diseases of trade and economic importance, such as FMDE, PPR, and Avian Influenza.

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 diseasefree zones 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.

The focus of the current government is on breed improvement for enhanced productivity, establishing a nucleus herd, identifying breeds that are well adapted to various agro-ecological zones of Pakistan, and importing high-yielding exotic dairy, beef, mutton breeds, and genetic materials. 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.

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

Table-I: Estimated Livestock Population (Million No)

Species	**2020-21[1]**	**2021-22[1]**	**2022-23[1]**	**GR %**
Cattle	51.5	53.4	55.5	3.77
Buffalo	42.4	43.7	45.0	2.97
Sheep	31.6	31.9	32.3	1.18
Goat	80.3	82.5	84.7	2.71
Camels	1.1	1.1	1.1	1.30
Horses	0.4	0.4	0.4	0.58
Asses	5.6	5.7	5.8	1.85
Mules	0.2	0.2	0.2	1.76

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

Table-II: Estimated Milk and Meat Production

Species	Units	2020-21[1]	2021-22[1]	2022-23[1]
Milk (Gross Production)	000 Tons	**63,684**	**65,745**	**67,873**
Cow	"	23,357	24,238	25,151
Buffalo	"	38,363	39,503	40,678
Sheep[2]	"	41	42	42
Goat	"	991	1,018	1,046
Camel[2]	"	932	944	956
Milk (Human Consumption)[3]	000 Tons	**51,340**	**52,996**	**54,707**
Cow	"	18,686	19,390	20,121
Buffalo	"	30,691	31,603	32,542
Sheep	"	41	42	42
Goat	"	991	1,018	1,046
Camel	"	932	944	956
Meat[4]	000 Tons	**4,955**	**5,219**	**5,504**
Beef	"	2,380	2,461	2,544
Mutton	"	765	782	799
Poultry meat	"	1,809	1,977	2,160

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**	**2020-21[1]**	**2021-22[1]**	**2022-23[1]**
Eggs	Million No's	21,285	22,512	23,819
Hides	000 No's	**18,751**	**19,384**	**20,039**
Cattle	"	9,759	10,127	10,509
Buffalo	"	8,878	9,142	9,414
Camels	"	114	115	117
Skins	000 No's	**60,837**	**62,250**	**63,697**
Sheep Skin	"	11,947	12,088	12,231
Goat Skin	"	30,946	31,784	32,645
Fancy Skin	"	17,945	18,377	18,821
Lamb skin	"	3,548	3,590	3,633
Kid skin	"	14,397	14,787	15,188
Wool	000 Tons	47.9	48.4	49.0
Hair	"	30.2	31.0	31.8
Edible Offal's	"	452	465	478
Blood	"	75.0	77.0	79.0

Casings	000 No's	61,461	62,888	64,351
Guts	"	19,929	20,599	21,292
Horns & Hooves	000 Tons	66.2	68.2	70.2
Bones	"	990.3	1,020.7	1,052.0
Fats	"	313.6	322.9	332.5
Dung	"	1,405	1,448	1,493
Urine	"	425	437	450
Head & Trotters	"	282.4	290.4	298.7
Ducks, Drakes & Ducklings	Million No's	0.37	0.35	0.34

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

Poultry

The poultry sector is a critical component of the livestock industry, providing employment opportunities to over 1.5 million people in our 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.

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.

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	2020-21[1]	2021-22[1]	2022-23[1]
Domestic Poultry	**Million No's**	**91.22**	**92.62**	**94.04**
Cocks	"	12.85	13.20	13.55
Hens	"	44.72	45.52	46.34
Chicken	"	33.65	33.90	34.15
Eggs[2]	"	4472	4552	4634
Meat	000 Tons	127.22	129.76	132.36
Duck, Drake & Duckling	**Million No's**	**0.37**	**0.35**	**0.34**
Eggs[2]	"	16.47	15.78	15.12
Meat	000 Tons	0.50	0.48	0.46
Commercial Poultry	**Million No's**	**1486.09**	**1632.06**	**1792.46**
Layers	"	64.01	68.49	73.28
Broilers	"	1,407.73	1,548.51	1,703.36
Breeding Stock	"	14.34	15.06	15.81
Day Old Chicks	"	1,470.38	1,617.41	1,779.16
Eggs[2]	"	16,797	17,944	19,170
Meat	000 Tons	1681.64	1846.48	2027.57
Total Poultry				
Day Old Chicks	Million No's	1,504	1,651	1,813
Poultry Birds	"	1,578	1,725	1,887
Eggs	"	21,285	22,512	23,819

Poultry Meat	000 Tons	1,809	1,977	2,160

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.*

Impact of Floods June-August 2022 on Livestock Sector

The floods that occurred from June to August 2022 in Pakistan, as a result of heavy rainfall, have had a devastating impact on the livestock sector. Table V provides a breakdown of the economic impact of floods on the livestock sector in the five affected provinces of Pakistan. The damages include losses on animals, damage to public and private infrastructure including animal shelters, veterinary hospitals and clinics, buildings of provincial departments, dairy and poultry farms. The total loss in the livestock sector due to the floods is estimated to be PKR 471 billion (≈ USD 2.3 billion).

Table V- Economic Impact of Floods on Livestock Sector

Province	Damages			Losses (PKR)	Grand Total (PKR)	Grand Total (USD)
	Damage on animals	Damage on Infrastructure - Private	Damage on InfrastructurePublic	Production Losses		
Baluchistan	4,004.1	0.0	55.3	79,972.6	84,031.9	409.6
Punjab	31.7	0.0	36.3	26,911.1	26,979.2	131.5
Sindh	17,573.2	7,710.3	145.5	260,459.1	285,888.0	1,393.5
KP	2,402.2	403.9	134.8	65,723.1	68,663.9	334.7
GB	135.4	15.9	1.0	5,369.3	5,521.5	26.9
Grand Total	24,146.6	8,130.0	372.9	438,435.1	471,084.5	2,296.1

Source: FAO Pakistan and the rate used for the conversion of PKR into USD is 205.163 as of June 2022.

Table VI shows the number of animals perished in floods by type and province. The data indicates that a total of 85,373 large animals, 411,800 small animals, 43,892 rural poultry birds and 257,731 commercial poultry birds were lost across the five affected provinces. The highest number of animal deaths occurred in Sindh, followed by Balochistan and KPK while GB and Punjab had comparatively fewer losses of animals and poultry birds.

Table VI- Animals Perished in Floods by Type and Province

Animal Type	Sindh	Balochistan	KPK	Punjab	GB	AJK	Grand Total
Cattle	33,480	9,664	7,932	98	528	21	51,723
Buffalo	30,774		2,868		4	4	33,650
Sheep	54,173	31,695	6,967	78	682	792	94,387
Goat	260,250	48,574	6,714	373	735	767	317,41 3
Other (camel, mules,	22	2,754					2,776
asses, horses.)							
Rural Poultry		25,038	18,634		220		43,892
Commercial Poultry		207,253	50,478				257,73 1

Source: FAO, Pakistan

Table VII shows the damage caused to the infrastructure by floods. The table shows that floods caused significant damage to animal shelters and dairy farms, particularly in Sindh and Balochistan, where 22,285 and 1,162 animal shelters were destroyed, respectively. Moreover, floods also affected veterinary hospitals and clinics and poultry farms in KPK, with 35 partially destroyed veterinary hospitals and clinics and 30 partially destroyed poultry farms. In contrast, Punjab, GB, and AJK did not report any significant damage to infrastructure. Overall, the data highlights the widespread damage caused by floods to the infrastructure, particularly in Sindh and Balochistan.

Table VII- Damage to Infra Structure by Type and Province

Description	Status	Sindh	Balochistan	KPK	Punjab	GB	AJK	Total
Animal Shelter	**Completely Destroyed**	5,976	1,162	-	-	-	-	**7138**
	Partially Destroyed	16,309	1,465	-	-	-	-	**17774**
	Total	**22,285**	**2,627**	-	-	-	-	**24912**
Veterinary Hospitals and Clinics	**Completely Destroyed**	1	-	4	-	-	-	**5**
	Partially Destroyed	102	-	31	21	2		**156**
	Total	**103**	-	**35**	**21**	**2**	-	**161**
Livestock Department Office	**Completely Destroyed**	-	-	4	-	-	-	**4**
	Partially Destroyed	14	-	-	-	-	-	**14**
	Total	**14**	-	**4**	-	-	-	**18**
Dairy Farm	**Completely Destroyed**	1084	-	409	-	566	-	**2059**

	Partially Destroyed		**-**	518	**-**	348	**-**	**866**
	Total	**1,084**	**-**	**27**	**-**	**914**	**-**	**2925**
Poultry Farm	**Compl-etely Destroyed**	**-**	**-**	28	**-**	**-**	**-**	**28**
	Partially Destroyed	**-**	**-**	2	**-**	**-**	**-**	**2**
	Total	**-**	**-**	**30**	**-**	**-**	**-**	**30**

Source: FAO.

Impact of Lumpy Skin Disease on Livestock Sector

Lumpy Skin Disease (LSD) is a vector borne viral disease of cattle and buffalo, emerged in Pakistan in November 2021 and has since spread throughout all four provinces, including GB and AJK. The disease is characterized by the appearance of nodules or lumps on the skin of affected animals, which can range in size from a few millimeters to several centimeters.The disease is transmitted by insect vectors, such as biting flies or mosquitoes, as well as through direct contact between infected and susceptible animals. The primary reason behind the spread of the disease in Pakistan was the mass movement of sacrificial animals during Eidul-Azha. Around 221,339 cases have been reported in Pakistan, but the actual number is likely higher due to the absence of a real-time disease surveillance system.

Although the mortality rate is currently less than 1% but has caused significant economic losses in terms of reduced milk and meat production, abortions, infertility, damage to hides of affected cattle, trade restrictions on animal products, loss of livelihoods for farmers, and distortion in the milk and meat value chain. Exotic breeds have been found to be more susceptible to the disease than local breeds, and a limited survey in the in districts of Rahim Yar Khan and Chakwal found that milk production was reduced by 72-73% for at least 60 days post-disease onset. The estimated economic loss if the disease remains uncontrolled is Rs. 80.4 billion based on the total susceptible cattle population of 53.4 million in the country.

There is currently no specific treatment for lumpy skin disease, and prevention efforts focus on vaccination and vector control measures. Vaccination

has been shown to be effective in reducing the incidence and severity of the disease, and can help to limit its spread.

The table provides summary statistics of LSD cases reported in Pakistan by respective provincial livestock departments and administrative areas of AJK and GB. It Punjab has the lowest morbidity rate of 0.239%, while AJK has the highest morbidity rate of 1.165%. KPK has the highest mortality rate of 0.0532%. The total number of cases in Pakistan is 221,399, with 38,092 animal deaths and a mortality rate of 0.0917%.

Table VIII - Summary Statistics of LSD Cases in Pakistan

Province /Administrative Unit	Cattle population	Total Cases	Animals Recovered	Animals Died	No. of Animals Vaccinated	Mortality Rate (%)	Morbidity Rate (%)
Punjab	14,635,446	35,046	26,509	1,242	2,261,178	0.0085	0.239
Sindh	11,392,469	53,668	53,097	571	3,711,538	0.0050	0.471
KPK	8,837,227	92,357	52,002	34,818	1,262,797	0.0532	0.844
Balochistan	6,140,540	22,225	12,520	469	89,586	0.0076	0.362
GB							
AJK	545,239	18,103	15,874	992	127,501	0.0653	1.165
Pakistan	**41,550,921**	**221,399**	**160,002**	**38,092**	**7,452,600**	**0.0917**	**0.533**

Notes:
Blank mean no data is provided / available

Ongoing Projects

The federal government has launched following programs under the Prime Minister's National Agriculture Emergency Program: -

Prime Minister Initiative for Backyard Poultry Project

This project aims to distribute five million high-laying backyard birds to the public across the country over a period of four years, at subsidized rates. These birds have already been pre-vaccinated, making them a low-maintenance and sustainable source of animal protein, which can help combat undernourishment in the population.

The total cost of the project is Rs 1.6 billion, with 30% of the funding being contributed jointly by the federal and provincial governments. The remaining cost will be borne by the beneficiaries. Since its launch in July 2019, the project has already distributed 3,257,205 backyard poultry birds to 454,293 beneficiaries across the country. This initiative not only provides a source of livelihood for these individuals but also contributes to the overall economic growth of the country.

Prime Minister Initiative for Save the Calf Project

This project aims to save 380,000 male calves from early slaughter over a period of four years by providing financial incentives of Rs 6,500 per calf to farmers. Under this project, baby calves within one month are registered and attain final weight of 80kg at the end of three-month registration period. In addition to reducing mortality rates through improved nutrition and husbandry practices, this intervention also provides stock for feedlot fattening, which enhances productivity and results in higher quality beef, leading to increased profits for farmers and reduced rural poverty.

The total cost of the project is Rs 3.4 billion, with the federal government contributing 20% of the total cost and the remaining funding being shared by provincial governments. Since its launch in July 2019, the project has already saved 201,286 calves through financial and technical support to 106,593 farmers across the country. In addition, 69,413 farmers have received training on improved husbandry practices and the calf-rearing business model. This initiative not only provides financial benefits to farmers but also promotes animal welfare and sustainability in the beef industry.

Prime Minister Initiative for Calf Feedlot Fattening in Pakistan

The Prime Minister's Initiative for Calf Feedlot Fattening in Pakistan aims to encourage farmers to produce healthy and nutritious beef by providing a financial

incentive of Rs. 4,000 for each calf in the country, while in Balochistan a cash incentive of Rs. 1500 is given for each fattened sheep/goat. This intervention promotes feedlot fattening as a viable business in the country, ultimately leading to economic growth and poverty reduction.

The project, which began in July 2019, has successfully provided financial and technical assistance to 54,817 farmers nationwide, resulting in the fattening of 235,667 calves. The total cost of the project is Rs. 2.4 billion. To optimize productivity before slaughter, calves aged one year are registered for a 90-day period and are able to achieve an average daily weight gain of 800 grams. In Balochistan, 310,000 kids/lambs have been fattened for mutton production. Kids/lambs are registered for a 90-day feedlot cycle, during which they gain an average of 10-15 kg with an average daily weight gain of 150 grams. Additionally, the project has trained 47,059 farmers on improved husbandry practices and the feedlot fattening business model.

Antimicrobial Resistance (AMR)

DAI Pakistan signed MoU with Ministry of National Food Security and Research to execute the Fleming Fund Country Grant Pakistan, a total funding of 5.8 million GBP by UK Department of Health and Social Care. The duration of this program is 2019 to June 2023 and has been working to tackle the growing threat of antimicrobial resistance (AMR). The program has several important objectives, including enhancing the policy environment for managing AMR, improving reporting on AMR, strengthening reference laboratories, improving data on antimicrobial consumption and usage, and promoting a One Health approach that encompasses human, livestock, and environmental sectors.

To achieve these objectives, the Fleming Fund is employing an evidencebased approach that takes into account the unique challenges and opportunities associated with AMR and AMU. The program aims to foster a mindset that prioritizes data-driven decision-making, establish a multi sectoral coordination mechanism at the national level, and promote information-sharing and coordination across public and private sectors.

In the animal health sector, the Fleming Fund is providing support for a range of initiatives, including:

i. Strengthening of AMR surveillance in food animals and have developed
    - National Surveillance Strategy for AMR in Healthy Food Animals
    - National Surveillance Strategy for AMR in Sick Food Animals
    - National Surveillance Strategy for AMR in Aquaculture

- National Surveillance Strategy for AMR in Food Animal Environment
- Pakistan Veterinary Laboratory Policy and Guidelines
- Antimicrobial Use Prescription Guidelines for Veterinarians in Pakistan
- Sampling Plan for Antimicrobial Resistance (AMR) Surveillance at Provincial Level in-line with National Surveillance Strategy for AMR in Healthy Food Animals

ii. Developed capacity building of federal and provincial veterinary laboratories
- Provided refurbishment, equipment's and consumables to 6 laboratories while trainings to 12 laboratories.
- 5 of these laboratories has started AMR surveillance iii. Have conducted Knowledge, Attitudes and Practices (KAP) surveys on AMU and drug prescription for dairy farmers and veterinarians. iv. Completed point prevalence surveys (PPS) on antimicrobial use in poultry and dairy sector to estimate the consumption of antimicrobials.

v. Extensively worked on advocacy of AMR for veterinary students, farmers and field veterinarians.

To better coordinate AMR and AMU activities in human health, the Ministry of National Food Security and Research has established the AMR Coordination Unit (AMR-CU) at the Animal Husbandry Commissioner (AHC) office. This initiative is a significant step towards combatting AMR and ensuring sustainable animal health in Pakistan.

TCP/PAK/3804 - Support development and piloting Pakistan Animal Identification andTraceability System (PAITS)

With the financial and technical support of FAO-Pakistan, the aim of this project is to establish a reliable animal identification and traceability system in Pakistan to effectively manage livestock identification and movements. The lack of such a system in Pakistan poses significant challenges for exporting livestock and their products, given the limited resources and capacity of animal health services to deliver effective animal health programs.

The project cost is 231,000 US dollars, and it has developed software-based modules for animal identification, registration, health, traceability, and monitoring dashboard. The project is being piloted in cattle and buffaloes of limited geographic regions, including all four provinces and federally administrative units, in smallholder livestock farming and selected feedlot fattening farms. Currently, the project is reviewing the legal framework of federal and provincial governments relating to animal identification and traceability, ensuring compliance and proper implementation of the system. The success of the pilot phase will enable the

replication of this software across the country and create opportunities for the country to access international markets.

National PESTE DES PETITS Ruminants (PPR) Eradication Programme

Under this project efforts will be made to move Pakistan into Stage 3 of the progressive step-wise approach of World Organization for Animal Health organization (WOAH) for PPR eradiation in two to three years. This will be achieved by maintaining an efficient surveillance system through better coordination between different laboratories and the use of bio-molecular techniques for epidemiology of PPR in Pakistan. The total cost of the project is Rs 1.8 billion.

TCP/PAK/3909 – Support for the Improvement of Animal Disease Surveillance System

With a total allocation of 175,724 US dollars, this project with the help of FAO aims to conduct a comprehensive feasibility study to develop an animal disease surveillance system tailored to the specific needs of Pakistan. The study will entail a thorough assessment of the current animal disease reporting systems at various levels in the country, with the aim of identifying their strengths, gaps, opportunities, and challenges.

The proposed system will leverage the latest technological advancements to enable real-time reporting of animal diseases, thereby facilitating appropriate and timely actions for disease control and prioritizing the allocation of resources necessary for prevention. The system will provide critical information to farmers, veterinarians, and other stakeholders, enabling them to respond to outbreaks in a timely and efficient manner, thus minimizing the impact of animal diseases on the economy and public health and safeguard the food supply chain.

Technical Feasibility for the Establishment of FMD Free Zone in Makran Division

A feasibility study will be conducted with the help of FAO to establish a Foot and Mouth Disease (FMD) free zone in the Makran Division in Southern Balochistan, Pakistan. The proposed area is surrounded by Makran Coast range, Central Makran hills range, Arabian sea, and an international border with Iran. The study will cover physical and technical requirements for the establishment of the FMD free zone, identifying locations for movement control posts, workshops for stakeholders, FMD vaccination plans, and the best way forward for Pakistan to establish the FMD free zone. The proposed area is mountainous, covers 26428.26KM2, and has a maximum distance of 698.81 Km.

Other Policy Measure

Livestock Wing with its redefined role under the 18th Constitutional Amendment allowed the following:

a) Import of calf milk replacer and cattle feed premix by the corporate dairy/meat sub sectors at concessional tariff.
b) Import of high yielding dairy cattle breeds of Holstein Friesian and Jersey for enhanced milk production
c) Semen and embryos of high yielding animals for the genetic improvement of indigenous low producing animals,
d) Import of high-quality feed stuff / micro ingredients for improving the nutritional quality of animals & poultry feed.

FUTURE PLANS

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. Bringing more investments in livestock sector
e. Exploring new markets for export of meat and dairy products with focus on Global Halal Food Trade Market
f. Development of National Livestock Breeding Policy, 2021
g. Development of National Poultry Policy
h. Development of Export Policy for livestock Products
i. Development of National Animal health Law
j. Breed improvement under Agriculture Transformation Plan; that has the objective to enhance national agricultural output and livelihood of farmers.

PART-I

ATTACHED /AUTONOMOUS DEPARTMENT OF M/O NFS&R

6. NATIONAL FERTILIZER DEVELOPMENT CENTRE (NFDC)

The National Fertilizer Development Centre (NFDC) a multi-disciplinary technical section was established in 1984 under the umbrella of planning and Development Division. The centre was transferred from M/o Planning Development and Special Initiatives to M/o National Food Security and Research (NFS&R) in 2018. The key mandatory function of NFDC is to give unbiased policy recommendations on various fertilizer related issues from factory gate/ 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.

Monthly Fertilizer Review reports

NFDC published twelve (12) monthly fertilizer review during 2022-23, which provided updates on supply demand situation of different fertilizer in general and that of urea and DAP in particular. Further, international and domestic price of fertilizer's are also mentioned for the readers.

Annual Fertilizer Review

Publication of Annual Fertilizer Review (AFR) is one of the regular activities of NFDC. The AFR 2021-22 has been published. It contains season wise (Kharif2021&Rabi 2021-22 and financial year wise 2021-22) 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 2022-23 was also made.

Fertilizer Demand Forecasting

Fertilizer demand forecasting was done on short as well as long-term basis. Under short term approach, the monthly fertilizer demands up to Kharif (September) 2023 was estimated, while on long term basis, annual estimates up to 2025 were calculated.

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. Multi-Nutrient Fertilizer	vi. Amino Acids
ii. Zinc Fortified Urea Fertilizer	vii. Potassium Humate
iii. Urea Phosphate	viii. Bio-Stimulant
iv. Paclobutrazol Growth Regulator Liquid	ix. Naphthyl Acetic Acid
v. Mono-Ammonium Phosphate	

Other Activities

- Reply to National Assembly / Senate questions relating to fertilizer availability and prices were prepared for M/o NFS&R.

- Two meetings were convened with Provincial Agriculture departments and M/o, Industries and Production to shift inbuilt from across the board subsidy on urea in the form of cheap natural gas to targeted subsidy for small farmers (up to 125 acres). Two committees have been formulated one for preparing report on Financing Mechanism for targeted subsidy programme and other for furnish report on targeted subsidy disbursement.

- NFDC played the role of whistle blower during 2022-23 and forecasted the shortfall in urea availability. On the basis of NFDC forecast, RLNG was given to two SNGPL based network plants during the calendar year 2022 and around 500 thousand tonnes urea was imported to fill the supply demand gap.

- Summary for the ECC of the Cabinet regarding Urea Fertilizer Requirement for calendar year 2023 was prepared.
- Participated and contributed in the meetings of Federal Committee on Agriculture (FCA), Fertilizer Review Committee (FRC), Technical Committee on Fertilizers and their Allied products and API's Standing Committee on Cotton/Sugarcane/Wheat Crops.
- Provided information/data to public sector organizations like Pakistan Bureau of Statistics PBS), Federal Board Revenue (FBR), Ministry of Industries and Production, Ministry of National Food Security and Research (NFS&R) and various private sector organizations like All Pakistan Textiles Mills Association (APTMA), Fauji Fertilizer Company Limited (FFC), ENGRO Fertilizer Limited (EFL) etc.

- Information/data to international organizations like International Fertilizer Association (IFA), Paris, France) and Food and Agriculture Organization (FAO of United Nations) was provided.

- Fertilizer related statistic including Prices an offtake along with analysis was provided to Economic Wing of Ministry of Finance for Economic Survey 2022-23.

- Data was provided to Economic Wing M/o, NFS&R for Agriculture Statistics of Pakistan 2022-23.

- The complaints/suggestions received on NFDC dashboard; Prime Minister Delivery Unit (PMDU) portal were responded timely.

7. National Veterinary Laboratories (NVL)

The National Veterinary Laboratory (NVL) of the Ministry of National Food Security & Research serves as the designated National Reference Laboratory for Livestock Diseases in the country. Its primary mission is to provide essential services and support to the national livestock sector, with the ultimate goal of enhancing profitability in livestock farming through effective disease control. The NVL's core functions encompass the following:

- Acting as the official National Reference Laboratory for Transboundary Animal Diseases (TADs) and diseases of Zoonotic, trade, and economic significance.
- Conducting residue analyses in livestock and poultry products as well as by-products to comply with the sanitary and phytosanitary (SPS) requirements of the European Union (EU) and the World Trade Organization (WTO).
- Undertaking quality testing of veterinary drugs and vaccines to ensure their safe and efficient use in animals.
- Providing technical assistance to provincial and regional livestock departments in containing highly pathogenic emerging animal diseases as they arise.
- Offering training programs and refresher courses on cutting-edge diagnostic technologies in the field.

Coordinating and collaborating with provincial and regional livestock departments, as well as international organizations such as the World Organization for Animal Health (OIE), Food and Agriculture Organization (FAO), and World Health Organization (WHO), to enhance animal health and public health standards. subtypes and matching strains for vaccines. As a result, Pakistan could develop country specific and effective FMD vaccines tailored to its needs.

Additionally, the section is actively involved in coordinating with the World Health Organization and the Fleming Fund UK to implement animal healthrelated

activities as part of the National Action Plan on Antimicrobial Resistance (NAP-AMR). This further demonstrates their dedication to safeguarding both animal and human health in the country.

***Training on Integrated Quality Laboratory Services (IQLS)**

***Hands onTraining for Isolation and Identification of Campylobacter Spp. From Chicken Caeca**

The Vaccine Quality Control (VQC) Section is an exclusive and prestigious facility that provides high-quality testing of vaccines to provincial/regional livestock departments upon request. It also plays a vital role in monitoring important and strategic vaccines such as Avian Influenza, FMD, and PPR to support disease control across the country.

The Drug Residue (D&R) analysis activity of NVL remained accessible to provincial/regional livestock departments throughout the year. This ensures the confidence of consumers and exporters in livestock and its value-added products.

The 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.

NVL offered advanced diagnostic technology, training, and refreshers during the period of 2022-23. The institution also supported internship programs and facilitated M.Sc., M.Phil., and Ph.D. studies, in line with its objectives.

Throughout 2022-23, NVL continued its participation in 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 project received funding of 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. 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. It actively coordinates various activities identified and implemented by the Fleming Fund.

***Hands on Training for Lowry Protein Assay and Estimation of Residual Formaldehyde in Veterinary Vaccines**

ACHIEVEMENTS

- National Veterinary Laboratories is served as national reference lab for the diagnosis & Surveillance of Transboundary Animal diseases (FMD & PPR).
- Diagnostic services provide to all Provisional / Regional livestock departments.
- Awareness and diagnostic services provided to livestock farmers from all over the country.
- Accredited (ISO/ IEC 17025: 2005) for FMDV diagnosis & Stereotyping& ESBL E.COLI detection.
- Key partner of FMD, PPR and all control programs currently executed in the country and Pakistan is at stage 2 of PCP for FMD and PPR at international level.
- Strengthen eight ELISA labs in collaboration with FAO, at strategic location for diagnosis of Transboundary Animal diseases (FMD & PPR) in all the provinces / regional of the Country.
- Technical backstopping and support to international labs in Afghanistan, Tajikistan, Uzbekistan and Turkmenistan.
- Annual refresher training courses for Lab workers on FMD & PPR diagnosis from all relevant provisional / regional labs.

- Provided Veterinary Drugs and Vaccine Quality Control services to all province / regional
  Livestock departments.
- NVL participate in Proficiency Testing (FMD, E. coli& Enterococcus)
- NVL participate in Proficiency Testing different Bacterial sample (NEQAS Program NIH))
- Establish FMD Virus repository (100 Fully Characterized FMD Virus isolated from Pakistan).
- More than 100 Internees, B.Sc, M.Sc, M. Phil and Ph. D students hosted and trained.
- Collaboration with FAO, WHO/ OIE regarding implementation of international health Regulation -2005 Activities in Veterinary sector of Pakistan.
- Established National veterinary Lab Working Group.
- 150 Vet Officers / Para Vets trained in10training programs.

YEARLY PROGREES PROGRESS REPORT JULY 2022 To JUNE, 2023

Section: Disease Diagnosis &Surveillance: VIROLOGY & MOLECULAR LAB		
Activities	**Area**	**Samples Analyzed**
Indirect ELISA for Antibody detection for Brucellosis.	Rawalakot, Wah cantt.	140
FMD Sero Surveillance (Trapping Indirect	Lahore, KP,	351

ELISA for FMD-NSP Antibodies Detection	ICT	
FMD Cell Culture Virus Isolation	NVL	25

Capri pox Double antigen ELISA for Lumpy Skin Disease		120
PPR Competitive ELISA		2318
Indirect Sandwich ELISA for FMD serotyping		341
FMD Antigen Detection ELISA		308
Solid Phase ELISA for FMDV Serotypes	Chiniot, Lahore	286
PPR Antigen Captured ELISA	ICT, Multan, RahimYar Khan	121
Confirmation of PPR Virus using RT-PCR Technique	ICT, Rawalpindi	197
Hematological Analysis of Blood samples (CBC)	ICT, Rawalpindi	361
Capri-pox Double Antigen Elisa for Lumpy Skin virus disease	Faisalabad	97
Sero-prevalence of PPR antibodies using cELISA	ICR, Rawalpindi, Gilgit Biltistan	599
PCR PPR	Rahim Yar Khan	166
Mycoplasma detection in vaccine samples		35
Confirmation of Campylobacter through PCR		10

Total		**5375**
Section: Disease Diagnosis &Surveillance: BACTERIOLOGY LAB		
Microbiological examination of Milk samples	Charrah, Taxila, ICT, Talaghanj	217
Microbiological examination of Water samples	Barakoh, RW International Islamic University Islamabad	P168
Microbiological examination of tissues, Pus & others culture samples	Tanda Pani, Tharamri	460
Microbiological examination of Fecal samples	Rawalpindi	629
Biochemical Examination of Milk using Commercial Strips, Mastitis Test	Charrah, Taxila, ICT, Talaghanj	217
Antibiotic Culture Sensitivity	Rawalpindi, Charrah, Taxila, ICT, Talaghanj	2767
Microbiological examination for ESBL coli, KP, Salmonella spp from chicken samples	ERawalpindi	160
Microbiological examination for Carbapenemase E. coli &Kp from chicken samples	Rawalpindi	160
Microbiological examination fo Campylobacter spp from chicken sample	Rawalpindi s	160

National External Quality Assessment services (NEQAS) for Provincial veterinary Labs supported by Fleming Fund organized	National Veterinary Lab	200

by External Quality Assessment services		
Hands on Training on Isolation and Identification of Carbapenemase and ESBL E. coli and Klebsiella Pneumoniae Provincial labs	Khyber Pakhtunkhwa Lahore t	---
Total		**5355**
Section: Disease Diagnosis &Surveillance: PARAHISTO LAB		
Faecal examination Techniques for Endoparasites	Islamabad, MVH, Chatta, BansraGali wildlife	408
Blood Smear examination Techniqu for eHaemoparasites diagnosis and confirmation	Military Vet Hospital, Polo club, Aiwan-e -sadder	396
Total:		**804**
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 Formalin Residue Estimation)	Sindh and Punjab	516
Maintenance of Animal house (Mice, Rabbits & Poultry	National Veterinary Lab	2099

3-Days Hands on Training on Lowry Protein Assay and Ferric chloride Titration given to officers from veterinary Research Institute Lahore (VRI Lahore)	National Veterinary Lab	04 Officers
Total:		**2615**
Section: Drug Residue Section: Residue &Drug Testing Lab		
Residue Detection in Honey by HPLC &	NVL	267
Internship students' samples		
Standardization of new protocol for residue detection in Honey samples by HPLC under Validation	NVL	185
Total		**452**

Other Activity:	
ISO-9001:2005 certification	Completed
ISO-17025-2017 certification (Selected Tests)	Completed
Internees	72
Post Graduate students	25
Training course conducted in NVL	10

8. DEPARTMENT OF PLANT PROTECTION (DPP)

1. Plant Quarantine

PROGRESS / PERFORMANCE DURING THE CURRENT FINANCIAL YEAR

- **European Union**

Pakistan is successfully exporting agro-commodities to EU member countries by meeting their Phytosanitary sanitary import requirements and the department is striving hard to keep the level of interception of agricultural goods at minimum level and avoid restrictions on import of agricultural good from Pakistan to EU countries.

- **Australia**

Pakistan has been exporting a number of agro-commodities to Australia, after conducting pest risk analysis particularly rice and mango etc., negotiations with the NPPO, Australia is underway for approval of more hot treatment facilities to further enhance the export of mango from Pakistan to Australia.

- **Russia**

DPP has got registered 15 rice facilities out of 27 rice facilities with the Federal Service for Veterinary and Phytosanitary Surveillance (PSVPS NPPO, Russian Federation for the export of rice to Russian Federation.

- **Mexico**

The Department with cooperation of Rice Exporters Association of Pakistan (REAP) and Pakistan Mission to Mexico is negotiating with SENASICA NPPO- Mexico for lifting ban on export of rice from Pakistan to Mexico. In July 2023 Mexican delegation experts visited the Pakistan for the verification of rice establishments.

For grant of market access for export of mango, peach, citrus and guava is in process from Pakistan.

- **China**

Currently, Pakistan has got the market access of cherries for export to China. DPP has got registered 4 more rice facilities for export of rice from Pakistan to China. To further enhance the export of sesame seeds, guar beans, and pine nuts, DPP has got registered 22 sesame export facilities and 08 guar beans facilities manufacture facilities for export to China.

- **South Africa**

DPP is in contact with the NPPO, South Africa for grant of market access of mango fruits from Pakistan to South Africa.

- **Korea**

This year, DPP got permission of exporting hot water treated mango to Korea.

- **Japan**

This year, DPP got permission of exporting vapor heat treated mango to Japan without pre-clearance programme.

- **Iran**

Bilateral trade between Pakistan and Iran is being continued smoothly. DPP is negotiating with NPPO, Iran for export of citrus from Pakistan to Iran.

- **GCC and KSA countries**

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

- **Capacity Building of traders/ stakeholders**

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 treatment providers to safeguard import/export consignments of agricultural goods.

c. 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.

- **Implementation of E-Phytosystem**

To further enhance the export of goods in order to ensure ease of doing business, reduces risk of fraudulent certificates, ensure accuracy, sustainability and authenticity of the legal documents under the provisions of ISPM-12 of IPPC, DPP is in process of establishing interface with IPPC ephyto hub, through which, the importing countries will be receiving phytosanitary certificate directly electronically through IPPC hub.

- **Regulations of trade**

To prevent entry of exotic and invasive pests, the Department is preparing phytosanitary import requirements after evaluation of the biosecurity risks of the imported goods from various trading partners.

2. REGISTRATION OF PESTICIDES

It is to inform that registration section has registered / permitted the following pesticides under different scheme during **01.07.2022 to 30.6.2023**.

SCHEME	FORM – 1	FORM – 16	FORM – 17	Total	Total Amount Collected
Registered/Permitted	67	345	335	**747**	**Rs.47,010,000/-**
Renewal	252	1925	1265	**3442**	**Rs.35,961,500/-**

- **Registration of Formulation & Refilling / Repacking Plants:**

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

SCHEME	FORMULATION PLANTS (FORM – 18A)	REFILLING / REPACKING PLANT (FORM – 19A)
Registered/Permitted fresh	20	28
Renewal	58	63
Total	**78**	**91**
Total Amount Collected	**Rs.10,223,000/-**	**Rs.4,256,000/-**

- **Revenue**

A revenue of **Rs.97,450,500** 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 01ST JULY, 2023 TO 30TH JUNE, 2023

		Sample Analyzed	Sample Failed		Pesticide Granules

S.No.	Month	Seaport	Registration	Seaport	Registration	Appeal case	Analyzed by PCSIR
1	July-2022	07	17	01	-		03
2	Aug-2022	22	34	-	-		01
3	Sep-2022	03	22	-	-	01	01
4	Oct-2022	-	19	-	-	-	03
5	Nov-2022	06	12	-	-	-	-
6	Dec-2022	09	18	03	-		02
7	Jan-2023	01	11	-	-		02
8	Feb-2023	06	19	-	-	01	04
9	Mar-2023	16	10	-	-		06
10	April2023	22	11	-	-		03
11	May-2023	22	41	-	-	01	02
12	Jun-2023	06	14	-	-	01	03
13	**Total**	**120**	**228**	**04**		**04**	**30**

Grand total: <u>378</u>

4. LOCUST SURVEY AND CONTROL

<u>Desert Locust Surveillance Activities in Pakistan</u>

- **<u>Summer-Monsoon Breeding Areas (July-December, 2022)</u>**

The routine fortnightly desert locust surveys were carried out in Tharparkar and Nara desert in Sindh, Cholistan desert in Punjab and Uthal, Balochistan from July – December, 2022. During the survey, an area of 266,800 hectares was checked and no gregarious as well as solitarious locust was observed anywhere in the provinces.

- **<u>Winter-Spring Breeding Areas (January-June, 2023)</u>**

The routine fortnightly desert locust surveys were conducted in locust prone areas i.e. Lasbela, Khuzdar, Nushki, Panjgur, Turbat, Gwadar and Pasni of Balochistan from January-June, 2023. During the survey, an area of 207,180 hectares was checked and no gregarious as well as solitarious locust was seen in the province. Routine locust surveys were also undertaken in Nara and Tharparkar

desert in the month of June, 2022. No gregarious or solitary locust was found, during survey carried out in 52,100 hectares.

- **Pak-Iran Joint Locust Survey 2023**

18 days Pak-Iran Joint Locust Survey in the spring breeding areas of Balochistan was undertaken separately by both the countries in their own territories w.e.f. 01-04-2023 to 18-04-2023, under the auspices of Food and Agriculture Organization (FAO) of UN. During the survey no gregarious locust activities were observed in Pakistan. However, low density mature scattered /isolated solitary adults were found at six locations at Kharan district. Likewise isolated mature solitarious adults were seen at five places at Noshki district. Similarly, isolated mature solitarious adults are found in two locations in Turbat district. After completion of survey, a single report was compiled and submitted to FAO.

- **Joint Border Meeting November, 2022**

Indo-Pak Joint Border Meeting between the locust experts of Pakistan and India to discuss the desert locust situation held at Khokhrapar-Monabao border point in November, 2022.

- **Desert Locust Control Committee Meeting, 2023**

42nd Session of Desert Locust Control Committee (DLCC) meeting, 2023 was held at Nairobi, Kenya in March, 2023 to discuss about the latest technologies for locust surveillance and control.

EXPORT FIGURES FROM JULY 2022 TO JUNE 23

Months	Rice	wheat	Food grain	Fresh/dry fruit and vegetables	Seeds and others	Raw cotton		Cotton products		Miscellaneous
	MT	MT	MT	MT	MT	Bales	Tons	Bales	TONS	MT
July 2022	336950.8	0.00	25.024	240736.6	8690.543		0.00		2981	49274.16
August 2022	248165.3	0.00	6.21	288385.7	17383.58		0.00		4356.369	154832.4
September 2022	208480.9	0.00	763	83115.91	51506.25		2746034		15	65031.59
October 2022	316289.7	0.00	1365.922	62809.56	29616.63		0.00		3888.76	74392.56
November 2022	375909.9	0.00	266.679	86424.11	18797.82		0.00		2271.52	131307.8

December 2022	1446741	0.00	3927.004	335652.3	57653.71		0.00		1935.968	66780.19
January 2023	358813.76	0.00	127396.589	375934.224	81281.907		290.42		1766.996	568512.796
February 2023	372452.335	0.00	69088.455	251001.602	62232.813		0.00		1624.68	91950.997
March 2023	434397.655	0.00	75426.752	220460.594	38879.468		0.00		2492.228	183701.941
April 2023	271193.957	0.00	29596.825	183271.17	3639.872		0.00		187.836	47438.393
MAY 2023	233717.587	0.00	38643.879	149152.384	5784.47		293.454		2558.91	123746.435
June 2023	271919.102	0.00	54006.466	121458.625	3043.491		11644.906		503.539	157790.185

Total	**4875031.996**		**400512.805**	**2398402.779**	**378510.554**		**2758262.78**		**24582.806**	**1714759.447**

IMPORT FIGURES FROM JULY 2022 TO JUNE 2023

Month	Rice	wheat	Food grain	FRESH/DRY FRUIT AND VEGETABLES	Seeds and others	Cotton/ fiber	Raw jute	Miscellaneous
	MT	MT	MT	MT	MT	Tons	Tons	MT
July 2022	0	161678	328000.2	52900.41	1728.642	5621.013	57919.86	8246.565
August 2022	0	338534.3	245828.4	47247.99	4118.61	8972.018	67907.72	51345.83
September 2022	0	296597.9	273484.4	52124.15	7482.932	10394.76	50942.32	10264.11
October 2022	0	183342.9	136973.7	82871.68	8579.931	19035.38	50827.57	49486.39
November 2022	0	-	153368	88078.69	12564.41	14089.4	77460.79	22770.53
December 2022	0	324663.287	110887.8	106906.8	26241.18	46790.53	135335.093	21440.14
January 2023	0	45131.8	1329745.558	113824.64	8696.32	112738.4	3069.854	70526.635
February 2023	0	32749.22	354970.6	99593.052	3327.59	86930.994	2334.86	27388.255
March 2023	0	379652.5	184815.279	38765.955	6470.783	9833.11	10407.4	28666.845

April 2023	0	146873	113040.474	17056.424	3363.875	95391.355	7142.508	11327.474
May 2023	0	50940	214630.737	30919.464	7073.276	84668.485	5075.005	28388.433
June 2023	0	0	192280.179	123954.479	4523.946	66937.892	3501.868	31621.374
Total		**1960162.907**	**3638025.327**	**854243.734**	**94171.495**	**561403.337**	**47192 4.848**	**361472.581**

Revenue from July 2022 to June 2023

MONTH	RELEASE ORDER		PHYTOSANITARY CERTIFICATE		IMPORT PERMIT		Fine charges	Anchor permit		Total Rupees
	NOs	Amount in Rs	NOs	Amount in Rs	NOs	Amount in Rs		NOs	Rs	
July 2022	2646	13230000	8467	21167500	1144	5720000	-	270	13500	40131000
August 2022	3324	16620000	8397	20992500	1941	9705000	-	385	19250	47336750
September 2022	3536	17680000	8081	20202500	2093	10465000	-	289	14450	48361950
October 2022	4300	21500000	7955	19887500	2058	10225000	-	275	13750	51626250
November 2022	4234	21170000	8084	20210000	1869	6045000		437	21850	47446850
December 2022	4822	24110000	10860	27150000	2991	14955000	-	586	29300	66244300
January 2023	3964	19820000	11286	28215000	2732	13660000	65000	468	23400	61783400
February 2023	3875	19375000	10901	27252500	1088	5440000	75000	442	22100	52164600
March 2023	3402	17010000	11577	28587500	1389	6945000	82500	490	24500	52649500

April 2023	2480	12400000	7845	19612500	1372	6860000	157500	384	19200	39049200
MAY 2023	3127	15635000	10145	25362500	2078	10390000	60000	401	20050	51467550
June 2023	2712	13560000	11484	29552500	1106	5530000	32500	414	20700	48695700
Total	**42422**	**21211 0000**	**115082**	**28819 2500**	**21861**	**10594 0000**	**472500**	**4841**	**242050**	**6069562 7050**

9. 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 2022-23 are as under:

MAJOR ACTIVITIES FOR THE YEAR 2022-23

- 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 2022-23.
- Prepared the presentation for Prime Minister on import subsituation and National Self Sufficiency in edible oil with Food Security Commission-I.
- POD is the member of Agriculture Taskforce group constituted by Prime Minister Office on 15-08-2022.
- A meeting with seed companies was held on 16-06-2022 at POD, HQ Islamabad to ensure the availability of seed for achievements of allocated sunflower sowing targets under the Project.
- POD participated in Inter-Ministerial (IMMs) virtual meeting on Pak GCC FTA & PAK-UAE CEPA dated 25-07-2023 and 31-07-2023.
- Promoted, in collaboration with Provincial Governments, oilseed crops and oil yielding plants and trees 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.

- A study on oilseed sector strategy completed by the consultation of FAO in June 2022 to review the oilseed sector of Pakistan.
- Contributed in the completion of Pakistan Economic Survey 2022-23 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 "Maximization of oil seed crops production in Punjab" dated 02-08-2023 in the Auditorium of Agriculture House, 21 ·Davis Road, Lahore**.**
- Present Government is striving hard to reduce our dependence on imports. Due to aggressive campaign and vigorous pursuance Federal Government during 2022-23, the area under oilseed crops has increased significantly from 1.053 million acres to 1.640 million acres for the first time since 2010-11. This shows 56% increase in area over the last year. Whereas the production has increased by 62% during the same period.

PROPOSED NATIONAL OILSEED POLICY

To address the issue of our dependence on imports of edible oils in the long run Federal government has 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 Ministry of National Food Security and Research is in process of presenting first ever comprehensive National Oilseed Policy to attain self-sufficiency in edible oil for 60% of country's requirements in 2034 by locally producing more than 4.793 million tons edible oils. In monetary terms there would be a substitution of US$7.668 billion.

Area and Production of oilseed crops during 2022-23

Area: 000' Acres & Production: 000' Tons						
Year	**2021-22**		**2022-23**		**Increase over last year (%)**	
Crops	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**
Rapeseed-Mustard	798	478	1260	785	58	64

Sunflower*	133	83	179	124	35	49
Canola	122	81	200	130	64	60
Total	1,053	642	1,640	1,039	**56**	**62**

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

ACTIVITIES OF "*NATIONAL* OILSEED ENHANCEMENT PROGRAM" (NOEP)

Targets for the FY- (2022-2023) in acres.

No.	Particulars	Punjab		Sindh*		KP		Balochistan	
		Targets	**Achieved:**	**Targets**	**Achieved:**	**Targets**	**Achieve:**	**Targets**	**Achieve:**
1.	**Subsidy on seed**								
	Canola Sunflower Sesame	56,623 65,143 86,400	41,233 85,887 149,933	20,000 110,000 11,000	00 00 00	10,000 5,000 1,000	6862 2082 51 (in process)	16,000 16,000 8,000	00 00 (under process)
	Total	**208,166**	**277,053**	**141,000**	**00**	**16,000**	**89,95**	**40,000**	**00**
2.	**Demo plots**								
	Canola Sunflower Sesame	30 30 15	30 27 8	00 00 00	00 00 00	05 05 02	05 05 02	12 12 09	00 00 09
	Total	**75**	**65**	**00**	**00**	**12**	**12**	**33**	**09**

3.	**Mega farmer gatherings**	30	95 (Smart gathering)	00	00	14	12	14	00

*Sindh component has not come on board so far.

- 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

***Monitoring team visit to the sunflower and sesame field in Punjab**
Promotion of olive cultivation on commercial scale in Pakistan

- **Physical progress (2022-23)**

Targets (2021-24)	**2022-23**			**Remarks**
	Target	**Achieved**	**%age**	
Plantation (75,000 acres)	24200	4,697	19.4	• Reduced release of funds • Higher farmer share for

Drip Irrigation System (5,000 acres)	1700	849	49.9	plantation and drip irrigation system hampered the demand
Trainings (129 nos.)	47	49	100	Activity is continued
Plant Propagation (3.2 m)	1.089	0.647	59.4	Activity is continued
Adaptability Trials (53 nos.)	19	21	100	completed
Fruit processing Units	05	0		Could not be achieved due to austerity
				measures
Equip. for certification labs (05 nos.)	03	0		-do-
Nursery infrastructure (50:50) 10 nos.	05	0		**-do-**
Post harvest kits (50:50) 500 nos.	-	-	-	
Grafting of wild olive (m)	2.0	0.034	1.7	
Overall Progress %			**55.5**	

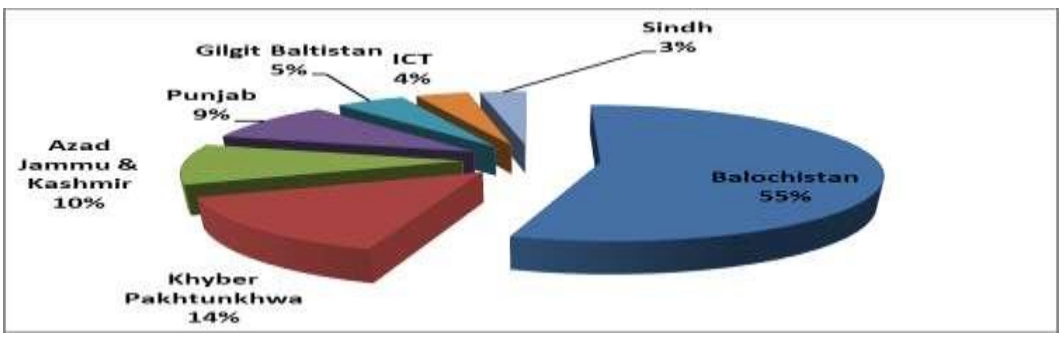
* The higher farmer share (33%) for plantation and drip irrigation system is hampering the demand among resource poor farmers, consequently less no. of applications received.

- **Final Progress (2021-23)**

Major Achievements (2022-23)

1. <u>Olive Plantation</u>

Advertisement was published in national newspapers for collection of applications from farmers to get olive plants on 67 percent subsidy basis. As per available demand and budget, tender was floated for procurement of 634,184 local certified olive nursery plants. After completion of all set formalities and SOPs the plants were provided to the farmers. Local certified varieties included Gemlik, Jerboui, BARI Zatoon-I, BARI Zatoon-II, Manzanilla etc. Plants were distributed among all provinces as per demand received through farmers at project's provincial components.



This year a major share of olive plants 55% (349,151 plants) was provided to Balochistan which shows the interest of Balochistan's farmers in olive farming followed by KP 14 % (91,000), AJK 61,000, Punjab 60,000, GB 30,000, Federal 23,000 and Sindh 20,000. Overall 4,698 acres have been brought under olive cultivation across the country on public and private lands.

Local olive nursery plants are procured from the registered nursery through proper certification and barcoded tagging by Federal Seed Certification and Registration Department, M/o NFS&R.The google earth coordinates are being taken for each plantation site accordingly.

2. Installation of Drip Irrigation System

Development of efficient water saving technologies for culturable waste is also the mandate of the project. For this purpose, during 2022-23 drip irrigation system was installed on 824.75 acres under the project at 02 public and 50 private olive farms in Balochistan, Khyber Pakhtunkhwa and Punjab. Out of the total acreage 779.75 acres were installed on private farms whereas only 45 acres were installed on public land. Geo mapping of each site has also been done.



3. Capacity Building/ Seminars/Trainings

In current year 2022-23, around 50 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 3756 participants (average 75 participants/training) including women, attended these trainings in Punjab, Khyber Pakhtunkhwa, Sindh, Gilgit Baltisthan and Balochistan.


i. 3rd International Conference

One day International conference on "Olive Value Chain- A smart Intervention for better future" held on 7th June 2023 at Barani Agriculture Research Institute, Chakwal jointly organized by PSDP olive project and Centre of Excellence for Olive Research and Training (CEFORT).

The aim of the conference is to present & discuss the current Forefront of R&D in this sector, to reflect on the prospects and challenges of today's fundamental olive culture and future Agriculture. The conference follows the footsteps of previous achievements in this sector. The event will provide a platform to the Scientists, professionals, Academia, Progressive olive growers, Processors, Service Providers, Entrepreneurs, Associations, NGOs, Government officers, Policy Makers, foreign delegates, civil society, rural women, youth, and other relevant stakeholders to share their valuable experiences and interact to develop recommendations for sustainable development of olive sector in Pakistan based on available scientific evidence. Participation from various National and International R&D organizations graced the important event.

*** 3rd International Conference on Olive at BARI Chakwal**

ii. 4th National Olive Festival

National Olive Festival was organized at Barani Agricultural Research Institute, Chakwal in collaboration with Center of Excellence for Olive Research and Training (CEFORT) on 18th-19th March, 2023 for awareness about olive oil quality, value added products being developed in Pakistan and efforts being made by government for development of this sector.

The event provided olive sector value chain players a platform to witness the latest developments as well an opportunity to interact with Academia, Research & Public Sector Dev. Agencies, Olive Growers, Olive Processors, Service Providers, Olive Associations, NGOs, experts, Donor/Development partners, foreign missions, and other relevant stakeholders. More than 25 entrepreneurs and

other value chain players displayed their products in the exhibition besides participation of more than 50 delegates from various organizations across olive value chain.

***Highlights from National Olive Festival at BARI Chakwal**

iii. Olive Gala 2023 at Khyber Pakhtunkhwa

First ever Olive Gala festival was organized by PSDP olive project at Agriculture Research Institute, Tarnab, Peshawar in collaboration with "Olive Culture - Holistic & Multi-professional Mechanism for a Pakistani Olive Value Chain" being implemented by CIHEAM BARI, Italy on 11th March, 2023.

The Olive Gala is aimed at showcasing different olive value-added products in Pakistan and providing a platform for various institutions, businesses, farmers, youth, women, consumers' and entrepreneurs to improve the economic, productive and quality aspects of olive crop. It is an opportunity to promote olive cultivation in the country and educate the public about olive cultivation. It will provide learning & unique opportunity through loca1 and international experts about the latest developments in the olive oil value chain.

Establishment of Laboratories for olive oil certification:

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 export in near future. For this purpose, a reference laboratory for olive oil quality and its certification 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.

iv. International Funded Olive Projects

1. Olive Culture Project-*A Holistic and multi professional mechanism for a Pakistani olive value chain*

The said project was conceptualized in December 2019 during the visit of National Project Director to CIHEAM BARI, Italy, wherein Italian and Pakistani experts put forwarded the idea of pivotal technical assistance in multiprofessional manner to improve the olive value chain in Pakistan. The project envisages 05 results which included technical and agronomic support, Promulgation of advisory council like Pakistan Olive Oil Council (POOC), Strengthening of certification labs according to the standards of IOC, establishment of Phyto Sanitary labs for isolation & identification of olive diseases, Strengthening the role of gender and youth in olive value chain and promotion of olive Argo tourism. This project is now implemented with the grant of € 1.5 million through Pakistan Oilseed Department, AICS and CIHEAM BARI, Italy funded by government of Italy.

2. TEVET Umbrella Project- Professional Capacity Building and Extension in Agriculture

The project deals with the specialized technical trainings by developing course contents and training infrastructures in olives and other fruit crops. The certain meetings for discussion and brainstorming on the contents and policy matters have been conducted between Pakistani experts and donor agency specialist. After all these meetings, a consolidated PC-I of cost €19.725 million was prepared and got approved from CDWP.

v. 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.

vi. Adaptability Trials

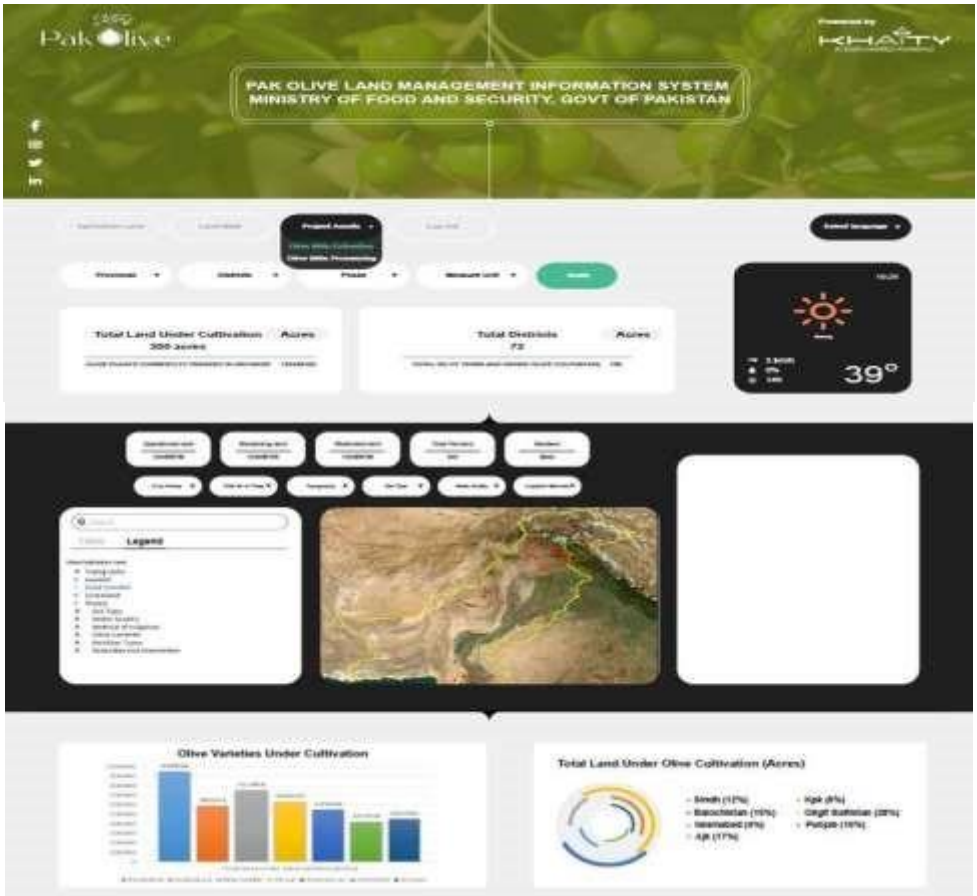
To examine the performance of various varieties in different Agro-climatic areas 21 adaptability trials have been planted this year. Variety wise data will be collected for morphological traits and oil quality parameters to assert the adaptability of olive in those areas.

vii. Indigenous plants propagation

During FY 2022-23, 659,495 cuttings were planted by different project components for propagation of true to type, disease free olive nursery plants.

viii. Formulation of Olive dashboard

A dashboard for olive crop has been developed.



ix. Bottle Necks and Suggestions:

Late authorization of Admin approval and fund releases

Reduced release of funds, increased rates of olive plants due to inflation affected the target achievements for olive plantation

The higher farmer share (33%) for plantation & drip irrigation system hampered the demand among resource poor farmers, consequently less no. of applications received.

Olive machinery and equipment could not be purchased due to austerity measure

x. Suggestions:

First steering committee recommended to revise plants subsidy on 85:15 basis instead of existing 67:33.

National Committee of Coordination on Agriculture & Food Security also recommended reduction in farmer share

i.

10. 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:-

The focus will be broader on agriculture policies. Focus will be general and adjustable keeping in view growing needs.

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:
Wheat, (Punjab & Sindh,
Cotton (Punjab and Sindh), and 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.

11. 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 SCIENCES DIVISION:

NARC-Crop Sciences Institute, NARC

Wheat Research Program, Crop Sciences Institute,

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

Genetic Improvement/Crop improvement

- Wheat program adopts introduction and evaluation of exotic/indigenous germplasm as well as hybridization in order to develop high yielding, disease resistant and good quality wheat varieties.
- Germplasm development/hybridization: About 755 crosses were attempted to develop diverse recombinants involving appropriate wheat parental material. Wheat program maintained 1440 populations at different filial generations (F1F6) and selected about 802 desirable populations for advancement and yield testing. About 2026 F7 head rows were planted at NARC and 163 genetically stable lines were selected on the basis of performance.
- Evaluation of elite lines: Wheat program evaluated 765 elite bread/durum wheat lines for yield, adaptability and other traits of economic importance in station yield trials and regional (multi-location) yield trials (RYT). Based on the performance at various stages of testing, 24 advance bread wheat and 02 durum wheat lines were provided to CDRI, NARC for testing against different diseases in National Wheat Diseases Screening Nursery (NWDSN). Four breed wheat lines were sent to FSC&RD for DUS study and 18 advance lines were contributed to the Provincial Uniform Wheat Yield Trials in the different provinces i.e., Punjab, Sindh, K.P and similarly in Gilgit Baltistan. Seven advance bread wheat lines were contributed for testing in the National Uniform Wheat Trials (NUWYT) under rain fed and irrigated conditions. In addition, two durum wheat advance lines were also tested in NUDYT during 2022-23 cropping season.
- Speed breeding: After establishment of Speed Breeding facility for Wheat Programme at CSI, NARC under PSDP project, the LED grow lights with

specific light spectrum installed for rapid generation advancement and made this facility fully functional. By using this facility 210 populations at different filial generations (F2 to F6) were advanced and about 75 new cross combinations were made. Each of this generation advanced from one generation to next in just 8 weeks and 310 different wheat populations are being advancing including populations from national and provincial institutes (WRI, CCRI, NIBGE, COMSATS, BARS and ARI).

***Hybridization in Speed Breeding Facility**

- Significant achievement: A high yielding, climate resilient and diseases resistance bread wheat advance line NR 533 has been approved by KP Seed Council for rainfed areas of KP with the name of WAFAQ-2023. The same variety has also been recommended by VEC for rainfed area of Punjab and Technical subcommittee of Sindh for irrigated area of Sindh.

- **<u>Productivity Enhancement</u>**

During crop season 2022-23, under PSDP- Productivity Enhancement of Wheat Project, 180 demonstration plots were planted on farmer fields/ research centers in the rain fed area of Potohar, Punjab, KP, Baluchistan, Sindh, Gilgit Baltistan and AJK. In these demonstrations, zero tillage planting, planting of wheat

on beds, planting of wheat on ridges, improved wheat varieties and wheat planting in cropping system (Sesbania-Wheat, Fallow-Wheat and Mung bean-Wheat) were demonstrated.

- **Production Technologies**

Sixteen different types of crop management experiments were conducted during crop season 2022-23, to find out the most suitable planting time, seeding density, fertilizers levels, Bio-fertilizers, Nano particles, zinc application through agronomic management practices, Biochar, Growth promoter, effect of Mg, to find out the best management practices, which should be high yielding, soil health & environment friendly and be economical for the farmers. Wheat planting during the last week of October had maximum yield in comparison with the first week of December and January. Maximum yield was recorded with seed rate 60 kg/acre as compared to different seed rates (20, 30, 40, 50& 60 kg/acre) in rainfed conditions.

- **Resource Conservation**

In Climate Smart project i.e., Consortium for Scaling-up Climate Smart Agriculture in South Asia (C-SUCSeS), 15 demonstration plots of different wheat varieties were planted/harvested. Under this project from the analyzed data of pooled site, Sesbania-Wheat System proved to be high grain yielder (kg/ha).

- **Human Resource Development**

During crop season 2022-23, 13 Field Days / Trainings were conducted in the different districts of the country including Dera Ismail Khan, Mirpur (AJ&K), Rawalpindi, Attock, Gujranwala, Narrowal, Mianwali, Gujrat, Gujar Khan and Sialkot. About 1448 farmers as well as staff of Agriculture Extension Department attended these events. Farmers were also guided for better wheat crop management through Zarkhaiz Pakistan Program of Radio Pakistan Islamabad. About 18 students from various universities completed their internships.

- **Quality Seed Production**

During reporting period about 259 ton of wheat seed of different categories cleaned, graded and distributed among the farming community. During crop season 2022-23, different wheat varieties (Pakistan-2013, Borlaug-2016, Zincol2016, Markaz-2019, Wafaq 2023 and AZRC Dera) were planted and harvested on an area of 348 acres for further multiplication and distribution among the farming community. The seed cleaning and grading process is in progress. About 300 tons of wheat seed of various categories is expected to be available for the next cropping season (2023-24).

- **Fodder & Forage Research Program**

The major objective of the program is research for productivity enhancement of fodder crops to fulfill the Fodder requirement of livestock in Pakistan.

- **Achievements.**
  - Selection of 60 lines of oat germplasm on the basis of green fodder yield, lodging resistance, late maturing and dual purpose characteristics.
  - Evaluated Sorghum (100 lines), Millet (110 lines), Sudan grass (21 lines), barley (30 lines) and vetch (13 lines). ○ Established production technology of six major fodder crops (oat, vetch, mott grass, maize, Sorghum and millet)

Oat Germplasm

Mott Grass Production

Vetch

Research Trial ○ Fodder program provided a total of 8.74 ton of quality seed that included Oats (80 ton), Millet (0.5 tons), Mott grass cuttings (0.24 tons) and maize seed (0.2 tons) to farmers. ○ Six oat and four vetch advance lines were contributed in National Uniform Fodder Yield Trials (NUFYT).

- Conducted adaptability trials of 05 Korean rye grass lines GF, GF2, GC, GC2 and IR604 with one local check.
- DNA profiling of NARC-Bajra for Distinctness, Uniformity and Stability (DUS) process to register NARC Bajra with FSC&RD is under Process.
- Successfully conducted first year Distinctness, Uniformity and Stability (DUS) with FSC&RD for PARC-oat.
- Fodder program facilitated research of 02 M.SC and 04 BSC students.
- Conducted demo plots of Oat, Vetch, Sorghum, Maize, Millet and Mott grass in Punjab, Sindh, Baluchistan, AJ&K and KPK.
- Established a detailed report on base line survey for dissemination of fodder production technologies in Pakistan.
- Conducted 03 farmer trainings for improved fodder production technologies at three different locations in Punjab, KPK and Islamabad with participation of 200 farmers.

- Submitted MoU project between Fodder & Forage Program, PARC and CHINA on Juncao grass.
- Presented a 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" o Submitted

ALP project in 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".

Pulses Research Program o

Genetic Improvement

- FourPromising advance genotypes contributed to NUYTs (1 Mung bean and 3 lentil).
- Identified disease resistant genotypes, 28 in chickpea against Ascochyta Blight, 18 lentils against stem rot and Ascochyta lentis.
- Identified 18genotypes in mash having erect plant type and naturally defoliation at maturity.
- Identified 12 genotypes in Lentil with erect plant type and lodging resistance, suitable for mechanized harvesting.
- Developed 20 cross combinations in chickpeas, lentils, mung beans, and mash to create genetic variability through hybridization.
- Advanced 15 filial generations (F1-F4) of Chickpea and Lentil through speed breeding in a glasshouse.
- Evaluated 925 genotypes for genetic diversity, including 244 in chickpeas, 311 in lentils, 97 in mung beans, 111 in mash, 80 in Faba beans, 59 in red kidney beans, and 25 in cowpeas.

o **Production Technology Improvement**

- All newly released varieties of Mung beans from the (NARS) were tested under Pothwar conditions, with NM-16 demonstrating the highest performance.
- Validated the application of macronutrients in Mung beans and Mash beans. The highest yield was observed when the macronutrients were applied either as a sole basal dose or through foliar application.
- The combination of Paraquat and Glyphosate has been proven to be the most effective desiccant for Mash beans
- The planting geometry of advanced lines of Lentil (LS-18-02, LS-21-01, and LS-21-02) has been validated.

- **Technology dissemination**

- A total of 110 demonstration plots were planted in the Pothwar region, covering districts Attock, Chakwal, Rawalpindi, and Jehlum. These plots aimed to promote and disseminate improved production techniques for chickpeas, lentils, mung beans, and mash beans. Additionally, machine harvesting techniques for mung beans were also showcased.
- Five farmer's field days, two awareness seminars, and two training courses were conducted at in districts Islamabad, Rawalpindi, Chakwal, Attock, Bhakkar, and Larkana. These events attracted over 1000 participants, providing them with knowledge and information of advanced production technology.

Seed Produced and Sold

	Mung bean	**Mash**	**Chickpea**	**Lentil**	**Total**
Seed Produced (kg)2022/23	10,000	1000	1000	1400	**13400**
Seed sold (kg)2022	5052	700	2400	683	**8,835**

Demo plot of Lentil at Mundi, Mulhal Kharif Experiments 2022 Mughlan, Chakwal

Awareness seminar at Jund, Chakwal

Pollination of emasculated Mash bean flower

- **Oilseeds Research Program**

- NARC-developed elite local sunflower hybrid (NARC-SUN-2020) was approved by Punjab Seed Council on 24thMarch, 2023 in its meeting held at Faisalabad after fulfilling all the requirements including VEC approval, spot examination and DUS data recording by FSC&RD.
- PARSUN-3, another sunflower hybrid developed by Oilseeds, NARC was submitted to KP seed council but due to non-availability of KP-multi-location data, its consideration was postponed until next meeting. All the deficiencies have been fulfilled and the case will be submitted to KP seed council again.
- Spot examination of two groundnut candidate lines PG-1221 and PG-1267 was conducted by Punjab Seed Corporation on 20 September, 2022.
- Spot examination of NARC-developed Sesame advance lines SG-132 and SG133 was conducted by KPK Seed Council in November, 2022.
- NARC-developed two Sesame advance lines SG-132 and SG-133 were presented in KPK Seed Council in December, 2022.
- Distinctness, Uniformity and stability data of mustard advance line MS-57 was recorded by the scientists of Federal Seed Certification and Research Department in 2022.
- Distinctness, Uniformity and stability data of soybean advance line SA-7260 was recorded by the scientists of Federal Seed Certification and Research Department in October, 2022.
- KPK Seed Council approved the commercial cultivation of soybean variety NARC-Soy-2023 in meeting held on 20-03-2023.
- Maintenance and Purification of inbred lines: During 2022-23, in total 40 and 220 inbred lines (A, B & R) of sunflower and rapeseed, respectively and 200, 132 and 164 accession/lines of groundnut, soybean, and sesame were planted for screening, purification, maintenance and seed increase.
- Development of new hybrid combinations: Twenty (20) new hybrid combinations each in sunflower and rapeseed were made during 2022- 23.
- During 2022-23, Oilseeds Program contributed a total of 22 advance lines / hybrids to NUYT for national testing in NUYT trials that included 06 Sunflower hybrids, 09 rapeseed-mustard lines, 03 Soybean lines, 01 Sesame lines and 03 Groundnut lines.

- Oilseeds Program (NARC) facilitated 20 BS students for their intern shiptraining and thesis research.
- The Oilseeds Program provided a total of 202tons of quality seed that included Soybean (175 tons), NARC Sarson (25 ton), Groundnut (0.5 ton), sesame (0.5 ton) and sunflower (1 ton) to farmers.

Demonstration plot of Plant of newly approved soybean candidate hybrid "PG-1267"

Plant of sunflower groundnut candidate line variety "NARC-Soy-2021"

"NARC-SUN-2020"

- **<u>Plant Physiology Research Program</u>**

Screening of crops germplasm for drought, heat and salt tolerance.

Plant Physiology Program, CSI, conducted trials on drought, heat and salt stress tolerance evaluation of wheat, rice, mung bean and maize germplasm at germination, seedlings and reproductive growth stages. 240lines of wheat, rice, maize, and mung bean germplasm were screened at germination, seedlings and reproductive growth stages in laboratory, greenhouse/glasshouse and field conditions with objective to identify climate resilient genotypes.

Evaluation was based on physiological and bio-chemical parameters like leaf chlorophyll, Proline accumulation, membrane stability index, relative water contents and stress tolerance index and agronomic parameters.Based on stress tolerance index (STI) and other physiological and agronomic parameters:

The results showed 04 NUWYT wheat lines and 03 advance lines showed heat stress tolerance (35-40 °C) at reproductive stage including NUWYT 10,38, 61 75 and NR-87, 88, 89.

10 NUWYT and 02 advance wheat lines were observed drought tolerant at (35% FC)

04 NUWYT and 02advance wheat varieties were found salt tolerant.

03maize lines i.e. ILC-88, C2P-132001and ILC-314 identified as tolerant drought tolerant at germination and seedling stage under PEG (20%) induced drought stress.

04 Mungbean lines identified as heat at flowering stage.

02 rice lines i.e. Chenah basmati and KSK-434 were identified as tolerant to saline alkali soil conditions

- **Collaboration / Capacity building**

The identified climate resilient crop lines were sharedwith crops breeding programs and recommended to promote or incorporation inbreeding to evolve high yielding and climate resilient cultivars.

Scientists &Plant physiology Lab. provided research facilities/training and supervision to 04M.Phil (research work & thesis) and 03 BS (internship & report).

- **Publications / reports writing**

- Plant Physiology Program published 01 research articles in refereed journal
- Witten annual, quarterly, and monthly reports of activities/research

- **Maize Sorghum and Millet Research Program**

One maize OPV (NARC Pops) was recommended in the 12th VEC meeting during December, 2022.

Seventy (70) maize OPVs of different categories (Y, W, Sweet & POP corn) were evaluated during spring 2023 and 02 high yielding OPVs were selected for PYT.

Ninety (90) hybrid crosses were evaluated phenotypically and on the basis of agronomic traits, and yield data 08 combination performed better than check.

Three hundred (300) inbred lines were selfed for generation advancement.

Various millet types like proso, foxtail and finger millet seed were acquired from PGRI, rejuvenated and agronomically evaluated. Evaluation of 40 proso millet genotypes reviled 03 promising genotypes. Similarly, evaluation of 20 finger millet and 35 foxtail millet reviled 02 and 04 promising genotypes respectively. Hundred more genotypes of these millet types are acquired for autumn 2023, evaluation.

Seed of 02 VEC approved varieties (NARC-2 & NARC-3), 12 sweet corn inbreeds and one POP corn variety was increased using time isolation.

Seven 07 tons seed of three OPVs (Haq Nawaz Gold, NARC 2 and NARC 3) was increased, two(~02) ton millet seed and sixty(60) kg Sorghum seed was produced.

- **Trainings**

Online training work shop titled “Speed breeding training workshop” was attended from 4-7th July 2022

Refresher webinar on FALL Armyworm Management in South Asia.

Training on “Agricultural Technologies Protection Using Intellectual Property Rights”.

Virtual Training on “Climate-Smart Agriculture”.

Online Symposium “China - Pakistan Agricultural S&T Academic Symposium”

- **Student Supervised**

Three M.Sc. students, One Ph. Dand fifteen internship students from various universities were supervised.

- **Research publications**

A research paper was published titled “SNP-Based Genome-Wide Association Mapping of Pollen Viability Under Heat Stress in Tropical Zea mays L. Inbred Lines”. (Front. Genet, IF: 4.77)

“Estimates of Genetic Effects for Physiological And Yield Related Traits In Maize Under High Temperature. Journal of Animal & Plant Sciences, 32(2): 2022, Page: 450-459

	
	
	
	
Maize DH Lab and Isolation Facility	Evaluation of germplasm proso and foxtail



DUS and Spot examination plots of MSM POP Corn Variety

- **Rice Research Program CSI NARC**

Germplasm acquisition and maintenance of crossing block:

A set of 60 temperate rice lines were acquired from PGRI-BCI NARC, and were evaluated for morpho-physiological, agronomic traits and disease reaction.

A set of 110 genotypes including indigenous coarse and basmati varieties, GSR lines, temperate japonica rice genotypes were planted as a historical set and for hybridization was planted.

Hybridization/recombinants development for combining ability and heterotic studies:

Rice breeding block comprises of more than 110 genotypes (historical coarse and basmati varieties, new indigenous varieties, obsolete cultivars, IRRI nursery, advanced lines and GSR lines) was constituted and planted in two different dates of sowing. More than 380 crosses combinations were attempted keeping in view the parameters i.e., high yield, disease (BLB, BLS) and insect resistance, short stature, short duration and lodging resistance. Out of which 105 successful cross combinations were achieved by using different schemes of combining ability study and gene pyramiding as mentioned below. A. **line x Tester for combing ability study:**

A set of 5 GSR lines and 4 coarse rice varieties have been crossed in line x tester mating design for hybrid vigor estimation and best combiner lines. B. **Diallel for heterosis and maternal effect:**

4 promising coarse genotypes have been crossed in 4 x 4 Diallel crossing fashion for combing ability study, heterosis, gene action and maternal effect. C. **Combining ability of A-line and TGMS line for hybrid development:**

A set of **25** GSR lines and cross with one two TGMS line for combining ability and heterosis studies. Good seed setting was achieved and harvested for plantation of F1 hybrids during 2023 rice growing season.

Filial generation advancement and selection:

- Two sets of 25 F2 progeny and 51 F3 progeny were raised from seeds of succeeding generation.
- Generation advancement ofF3 progeny was done and37 F4progeny seeds were harvested after selection for next season plantation.F4 progeny of four commercial hybrids (Pride-1, WDR, LP2 and LP18) was raised as reverse breeding for variety development and 10 panicles were separately harvested from 10 selected plants as F5 progeny (04) for next cycle of selection.
- **F_8 generation head rows:** A set of 160 F8 progenies of fine rice was raised (Basmati) that was received from NIAB Faisalabad was planted from selected single panicle harvested seed of F8and selection was done on single row selection/rejection method and 20 single rows were selected for next season trial plantation.

Mutation Breeding of Basmati Rice:

- Basmati cultivars were used in the mutation breeding acquired form NIAB Faisalabad after treatment of four levels of gamma radiation (350Gy, 300Gy, 250Gy, 200Gy). M4 population has been successfully harvested by selected bulk method keeping seeds of 50 selected spikes each treatment of radiation. M5 population will be planted for generation advancement and selection in segregating generation during coming rice season 2023.

Advanced Replicated Yield Trials:

Advanced yield trial (AYT-I-coarse): An advanced yield trialof coarse ricecomprising 20 fine rice lines (acquired from PGRI-BCI) containing two check cultivars was evaluated in triplicated (RCBD) yield trial with row x row and plant x plant distance 20cm in 6m2 plot area at CSI, NARC, Islamabad. Analysis of variance for yield reveals significant differences among genotypes for paddy yield. Two advanced lines out of 20 have been selected that have higher yielding (>8 tons/ha) and these lines will be contributed in Provincial Yield Trial 2023/multilocation trails.

Advanced yield trial (AYT-II):

An advanced yield trail comprising 45 GSR lines including two check cultivars (IR-6 and KSK-133) have been evaluated in replicated trials in alphalattice design. 10 line have been identified that have 8% to 12% more yield (>8 tons/ha) than check cultivar. These lines will be further tested at regional yield trials and multi-location trails during 2022.

Advanced yield trial (AYT-III):

An advanced yield trail comprising 25 lines from IRRI-IRLON nursery including two check cultivars have been evaluated in replicated trials in RCBD design. Only three lines have revealed higher yield than check cultivar KSK-133. These lines will be further tested PUYT and multi-location trails during 2023.

Advanced yield trial (AYT-IV):

An advanced yield trail comprising 44 lines from IRRI-IRLON nursery including two check cultivars have been evaluated in replicated trials in alphalattice design. 28 line have been identified that have 6% to 10% more yield than check cultivar. These lines will be further tested at station and multi-location trails during 2022.

Advanced yield trial AYT (Fine rice):

An advanced yield trialof fine comprising 24 fine rice lines (acquired from NIAB) were evaluated in replicated yield trial in RCBD design. Only two lines showed high yield (>5 tons/ha) have been selected for further testing in next rice cropping season at regional trials/Provincial trials.

Multi-locational yield and adoptability trail:

Advanced yield trail promising 20 lines of coarse rice with local check cultivars were evaluated at 8 different rice growing zones in four provinces and one at NARC Islamabad for stability in yield, adoptability and diseases/insect's assessment. Analysis of multilocation data revealed significant differences among genotypes and interaction G x E. Six stable lines were selected for contributed in the NUYT and micro trials.

National Uniform Yield Trials:

Five advanced coarse rice lines were contributed in the NUYT-2022 for yield stability, disease and insect screening. Yield performance of four lines was higher than local check cultivars and pool average yield of lines was recorded more than 5 tomes/ha.

Screening for germplasm for Disease resistance:

A set of 92 advanced lines (AYT-I, AYT-II & AYT-III, 2022) have been screened against bacterial leaf blight (BLB) in collaboration with CDRI NARC. Out of 92 advanced lines 21 lines showed highly resistance, 55 moderately resistant reactions, 14 showed moderately susceptible and two lines revealed susceptible reaction against BLB. These lines are already included in our advanced yield trials (AYTs).

Marker assisted Screening of rice germplasm for BLB disease:

DNA based molecular marker assisted screening of rice germplasm for bacterial leaf blight (BLB) done on 188 lines. DNA isolation of 118 GSR lines have been completed and five BLB resistant genes linked SSR markers (Xa4, Xa5, Xa13, Xa10 and Xa21) that conferred resistance against BLB were applied out of which 94 genotypes contained Xa4, 92 genotypes contained Xa5, 92 genotypes showed bands for Xa10, 57 genotypes revealed Xa13 gene and 106 genotypes showed resistant gene Xa21. Markers for susceptible genes of BLB disease was also applied, 83 genotypes showed susceptible allele of Xa5 gene, 110 genotypes showed susceptible allele of Xa13 gene.

Identification and screening of germplasm for Thermosensitive male sterile line (TGMS) to be utilized for hybrid development: For identification of thermosensitive male sterile line in rice germplasm, F2 population of two commercial two lines hybrid was planted in February 2022 and flowering was achieved during Mid-June 2022. On the bases of pollen microscopic study and field selection of plant with aborted pollens due to high temperature 10 plants were identified with sterile pollens and their clones were shifted to temperate region AJK for to achieve normal seed setting from TGMS plants. Successful seed was harvested for further study in during next season pf plantation and selection.

Optimization of Production technology for Candidate lines

Candidate rice lines were subjected for the optimization of seed rate and sowing time. 4 different seed rates were used at the rate of 4,5,6 and 7 plants acre in 3m2 plot for the 5 candidate lines contributed to NUYT 2022 with a local check for optimization of seed rate ensuring better results. It was found that NRP4 and NRP5 yielded maximum at seed rate 7kg whereas NRP 1 and check (1121) gave maximum yield at 6kg NRP 2 and NRP 3 at 5kg. Among all the lines, highest grain yield was recorded at NRP 3 and NRP 5 across all seed rates. On average it may be recommended that 5-7kg seed rate is best for manual transplanting method as it may be better to go for specific seed rate recommended for a certain line. In terms of sowing date optimization planting was done in 3 phases with an interval of 1 week among each for 5 candidate lines with a check variety. Overall maximum yield was observed in all lines at first date of sowing (28 -5-2022). Yield was higher in trial planted at second date (8-6-2022) as compared to 3rd sowing date (18-6-2022). It recommends to go for early rice transplantation to have better results.6 lines were screened against drought at different growth stages. According to visual observation and drought scale NRP2 and 5 showed tolerance against 7 days' drought stress at tillering stage while NRP 5 at booting stage and NRP 1, 2, 5 showed tolerance at grain filling stage. Proline analysis is in progress.

Submergence Tolerance Evaluation Trial

In submergence trial, a set of 20 promising lines have been planted for the evaluation of their potential to with stand for normal growth after being submerged for extended period of time (10 days) and their survival percentage was found. In case of 10 days' submergence survival, 07 genotypeswere found to be retaining their normal growth after water level goes down.

	
Rice hybridization for developing new cross combinations	Marker Assisted Selection of Rice Germplasm for BLB resistance through SSR Markers(Xa4)

On field evaluation of wider rice germplasm for selection

Rice Research Programme Kala Shah Kaku, Lahore

• Forty-five (45) new cross combinations were completed during season 2022. Out of 45 crosses, twenty (20) cross combinations were selected for Line into tester (5 × 4 = 20) mating design. F2 seeds were also harvested from fortytwo (42) F1 hybrids. Super Gold and PK-1121 were found the best general combiners to improve yield and yield contributing traits.

• Direct seeding of rice is an alternate method of rice crop establishment avoiding nursery raising, uprooting, transplanting and puddling operations. Severe weeds infestation is a major issue in DSR technology due to favourable conditions for weeds seed germination. To overcome the weed problem, pre emergence and post emergence herbicides were tested under field conditions. Pre emergence herbicides included pendimethalin @ 2500 mL ha-1 and Council Activ @ 187.5 g ha-1, while post emergence herbicides included: Greensun (Metamefop EC) @ 1250 mL ha-1, Ricer (Cyhalofop butyl+ Penoxulum) @ 2500 mL ha-1, Puma super 7.5 EW@ 625 mL ha-1 + Bispyribac sodium @ 250 g ha-1, and Leptokill (Fenoxaprop-p-ethyl + Penoxulum) @ 687.5 mL ha-1. Both pre emergence herbicides depressed equally the total weed density and biomass. Regarding post emergence herbicides, mixture of Puma super 7.5 EW@ 625 mL ha-1and

Bispyribac sodium @ 250 g ha-1performed better in decreasing total weeds density and biomass. The maximum paddy yield (2541 kg ha-1) was also recorded from the same treatment.

- An experiment was conducted at PARC Farm KSK to determine suitable sowing time of rice under changing climatic conditions with help of DSR drill. The maximum paddy yield (4455 kg ha-1) was obtained from seeding on June 10th depicting the best sowing time of dry seeded Basmati Rice.
- Rice sowing with DSR drill at seed rate of 27.5 kg ha-1 produced the maximum paddy yield of 3106 kg ha-1 and it was found as the optimum rate for obtaining good yields of Basmati Rice under DSR system.
- Demonstration experiments were conducted at different locations of Gujranwala and Sheikhupurato apprise the farming community with new crop establishment technologies in rice wheat area. Direct Seeded Rice (DSR) and Mechanical Transplanting (MTR) were compared with Conventional Transplanting (CTR) methods. Higher average paddy yield was recorded from Mechanical Transplanting (4192 kg ha-1) compared with DSR (3922 kg ha-1) and CTR (3654 kg ha-1), however, the economic analysis exhibited the maximum net income and benefit cost ratio (Rs. 109050; 2.27) from DSR followed by Mechanical Transplanting (Rs. 106100; 2.02) and conventional Transplanting (Rs. 85400; 1.90).
- 196 Rice lines (36 Fine, 20 Coarse and 140 Rice hybrids) were evaluated under National Uniform Yield Trials and data were collected on different crop parameters.
- Germplasm comprising 83 selected rice lines was managed at PARC Farm for characterization of the material in collaboration with BCI, NARC, Islamabad.
- INGER nurseries comprising of 125 entries of International Irrigated Rice Observational Nursery (IIRON), 51 of International Upland Rice observational Nurseries (IURON) and 58 of International Rice Soil Stress Tolerance Nursery (IRSSTN) were evaluated in collaboration with the National Coordinator Rice, PARC and multiplied seed for further studies.
- Cooperated with SSRI, NIGAB, CAEWRI, LRRI, RRP NARC, Islamabad regarding their field experimentation and surveys

Fig1: Rice hybridization for developing new cross combinations

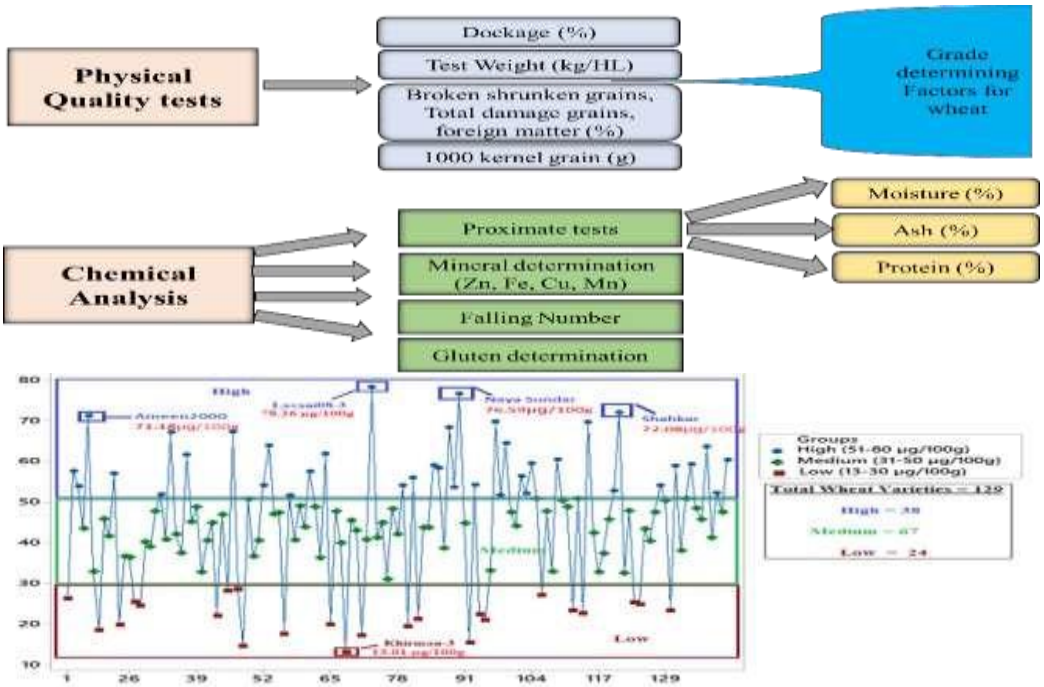
Fig2:Nursary sowing and field evaluation trials of Rice germplasm

Fig 3: Demonstration trials of DSR and Mechanical Transplantation

Food Science Research Institute

Grain Quality Evaluation of Wheat & Rice

Grain quality evaluation is the pre- requisite for well informed decision to support variety recommendation process, end use assessment and to support trade at national or international level. More than 20 types of quality tests (Physical, milling, nutritional/proximate, safety, rheological, cooking quality, Baking quality etc.) are performed, data is gathered and analyzed to report the results to different stakeholders of public and private sector. In the FY 2022-23, 341 wheat samples (varieties/line/flour) from different research institutes/centers were were evaluated for folic acid, gluten, protein, Ash, moisture, falling number, farinographic properties and mineral analysis etc. Total of 1081 tests were performed and 82 internees were trained on wheat quality analysis.

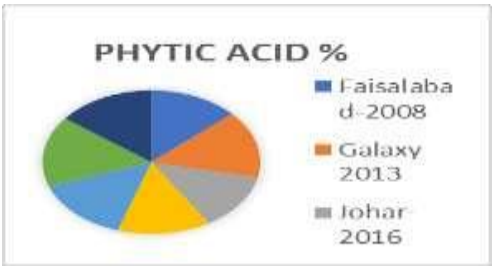


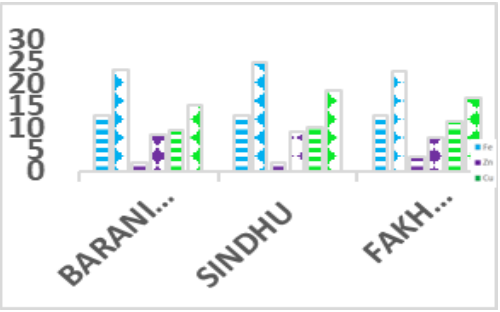
Quality Characterization of dephytinized wheat

Micronutrient deficiencies of iron, calcium and zinc are prevalent in Pakistan. Wheat is one of the largest cultivated staple crops and is the second most widely consumed worldwide. It is a rich source of carbohydrates, proteins, fat, minerals as well as vitamins and phytochemicals. Wheat also contains a significant amount of phytic acid, which is the major storage form of phosphorus in cereals and it also acts as a natural anti-nutrient substance. Phytic acid is known as a food inhibitor which chelates micronutrients and prevents them from being bio available to humans, because they lack enzyme phytase in their digestive tract.

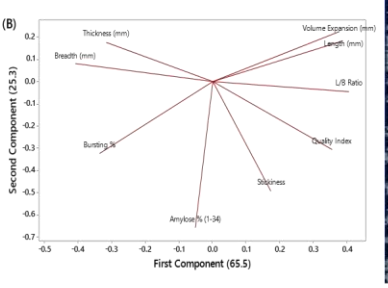
Pakistani wheat varieties around 60 were analyzed for essential minerals (iron, zinc, copper, manganese) and anti-nutrient phytic acid content, Additionally, Enzymatic dephytinization by exogenous phytase enzyme, in vitro gastrointestinal digestion, solubilization of the enzymatically hydrolyzed products, dialysis over a semipermeable membrane, and bioavailability assessment of the of iron, zinc, and copper were done.

The dephytinized flour was found have increased minerals bioavailability as a result of reduction in phytic acid content. Different wheat varieties had bioavailable iron ranging from 11-24%, zinc 4-10% bioavailable and copper about 6-20% bioavailable. Further bakery products cookies and bread were developed with increased nutritional value because of more bioavailability of minerals. It was evident from research studies that dephytinized flour has potential to be promoted and commercialized to address micro nutrient deficiencies and to increase the nutritional value of food products.





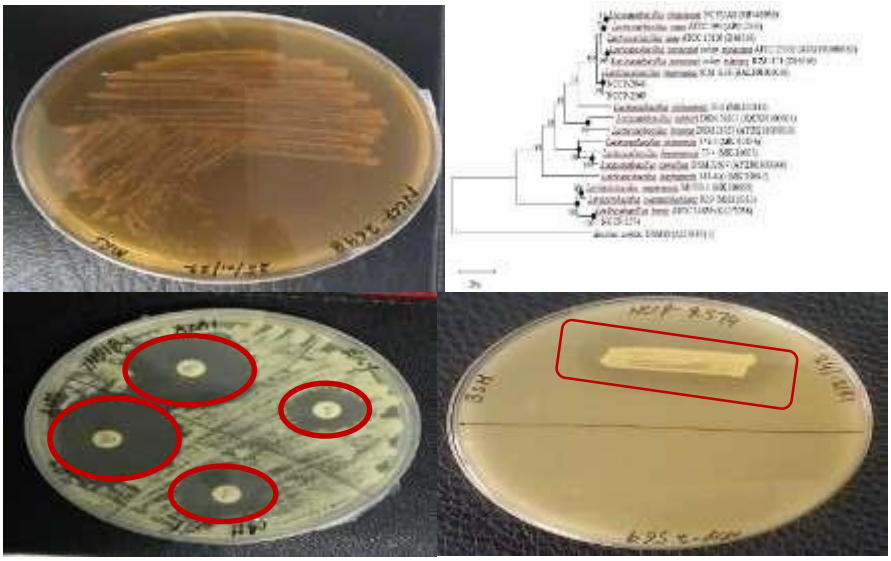
In case of rice, 360 samples from National Coordinator (Rice), Rice Research Program, NIGAB, NARC, Rice Research Institutes of Sindh, Syngenta, etc. were evaluated against 19 different milling, physical, nutritional (Fe & Zn) cooking and chemical (amylose, gel consistency and alkali spreading value) quality parameters. All the data obtained being analyzed statistically. Method for physical quality and milling quality analysis through 3 D- Micron Grain Scanner, Newly procured Dehusker and grain polishing machine are being standardized & optimized.



Isolation, identification and characterization Probiotic bacterial strains

Probiotics in live form can be a good source to improve the body's immunity and nutrition through better digestion and absorption but they have limited survival throughout the shelf life when added to the foods. In Pakistan, research on probiotics and their use is in the infancy stage and being done in pockets. Mostly studies were confined to conventional microbiological methods of screening, identification and characterization. Little focus has been on indigenous food sources, use of different

media for isolation, detailed bio-chemical characterization, interactions with food pathogens, bio-safety related to anti-biotic resistances and haemolysis and whole genome sequencing aspect to exclude any undesirable genes. A 02-year research study was completed wherein probiotic bacterial strains have been isolated from different food sources and then characterized comprehensively for health, nutritional benefits and product development. Total of 81 food samples were collected from different regions of Pakistan from which 342 bacterial strains were isolated. From 341 strains, 89 morphologically distinct strains were identified on the basis of 16S rRNA gene sequence analysis. Based on bio safety assessment (hemolytic activity and antimicrobial susceptibility test) 29 promising probiotic potential bacterial strains were selected for further analysis. Among the characterized strains, whole genome of 6 candidate probiotic novel bacteria were sequenced. Based on invitro and in silico characterization, strain NCCP-2648 was used in production of functional pickle.



Polyphenols extraction from fuit waste and its utilization

Polyphenols are natural antioxidant in plants especially in fruits, vegetables and herbs that have a vital role on human health as antioxidants, anti-allergic, antiinflammatory, anticancer, antihypertensive and antimicrobial agents. Fruit wastes have comparatively higher concentration of phenolic compounds than pulp and have more antioxidant activity.

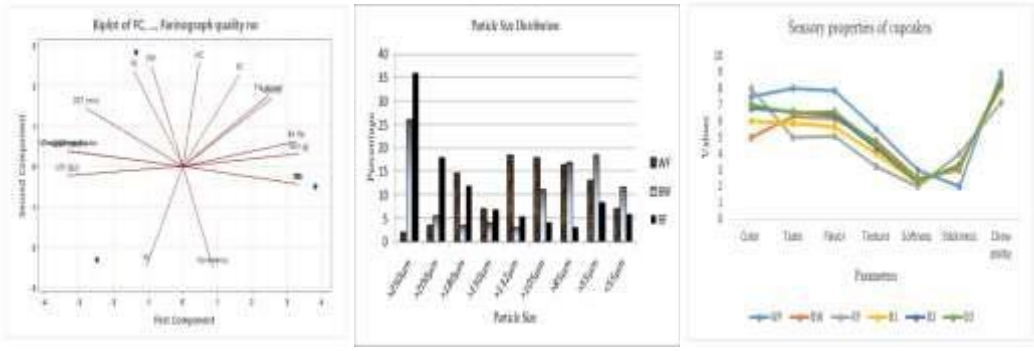
Extraction of polyphenols through sonication was carried out from different fruit wastes (05 types) and herbs/medicinal plants (10). Total polyphenols, flavonoids and antioxidant activity of extracts were determined. Functional fruit bars/date bars containing extracted polyphenols were developed and evaluated for quality parameters.

Fruit waste and herb polyphenolic extracts may be utilized as ingredient for the development of different functional foods.

Polyphenolic Extracts Fortified Fruit Bars

GLUTEN FREE PRODUCT DEVELOPMENT

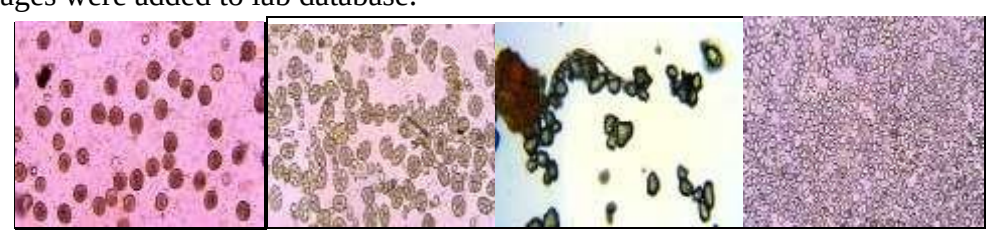
This research was conducted to investigate the physicochemical and rheological characteristics of buckwheat and rice flour as raw materials for glutenfree cupcake formulations and their relationship to cupcake quality. Formulations of gluten-free cupcakes based on buckwheat and rice flour in three different ratios 10/90, 20/80, and 30/70 were developed. Physicochemical and rheological analysis indicated that gluten-free buckwheat and rice-based composite flours exhibited significant differences between proximate composition and falling number range in comparison with wheat flour. The particle size of rice flour was finer in comparison to buckwheat and wheat flour. Buckwheat flour was combined (as the darkest flour) with rice flour (as the brightest flour) and prepared cupcakes of significant difference in lightness in comparison with wheat flour-based cupcakes. Overall sensory scores given to cupcakes were increased with increasing levels of buckwheat flour. That reveals more consumer acceptability by increasing the concentration of buckwheat flour. There was a significant difference in proximate composition and physical properties of cupcakes after the increased content of buckwheat flour. After 8 days of storage, there was a notable decrease in moisture content in all of the cupcake samples and no remarkable difference was observed between fat content and protein content. Sensory scores for all of the samples were significantly decreased after 8 days of storage except for softness and stickiness because they expressed a little difference in scores after storage. A non-significant decreasing trend was noticed in the height of cupcakes as compared to weight during storage.



Microscopic study of Pollen Spectrum of different honey flow seasons to determine botanical origin

A study was conducted for microscopic identification of pollen particles and determination of honey floral source. In this study, identification of particles from different adulterants was also carried out in order to optimize the microscopy techniques for ensuring honey quality and authenticity. For pollen identification, pollen samples were collected by three methods; directly from flowers of different floral sources, from pollen frames of different honeybee colonies and from extracted honey samples. After collection, these pollen samples were subjected to microscopic analysis through IHC Melissopalynological techniques. Pollen images were taken and reference slides were prepared to form a reference database. Reference pollen database has been established for some honey floral types including Sider, Acacia, Shisham, Granda, Bhaikar, *Trifolium* sp., Eucalyptus, Brassica sp. Sunflower, Kachnar, Berseem, Citrus sp.

For adulteration source identification, direct adulteration of different honey samples was done in order to identify the particles of certain products, which are suspected as most common adulterants in honey. For this purpose, solutions of adulterants like sucrose, starch and sugar cane syrup were prepared at different concentrations i.e 25% and 50% and were were analyzed through microscopy. Microscopic particles of common adulterants i.e Sucrose and Starch were identified and their reference images were added to lab database.



Sider Pollen (20x) Acacia Pollen (20x) Starch particles (20x) Crystal particles (20x)

On-going Projects:

S. No	Project title	Funding Source
1	Grading and end use quality assessment of wheat to facilitate local use and export	PSDP
2	Strengthen rice quality assessment system in Pakistan	PSDP
3	Characterization and Grading of Capsicum Germplasm for Capsaicin Contents for Market Use	ALP

Quality Analysis Services 2022-23:

Sr. No	Sample's Source	Total samples	Total Base Price in Rs.	Total Sale Price in Rs.
1	Beekeepers, honey traders and exporters	471	10,37,450	16,16,900
2	PATCO	782	954, 800	16,14,500
3	Individual/Private companies	91	200,000	315,000
Total samples		**1344**	**21, 92, 250**	**35,46,400**

Fruit Crops Research Program

Research Activities / Varietal Development Approval of Exotic Grapes germplasm

Razaki seedless variety of Grapes is approved from KP seed council. The Fruit Crops Research Program acquired Grape germplasm from Turkey and evaluated at HRI, NARC. Results revealed that '**Razaki**' is very early



maturing variety in comparison with the check variety '***Superior Seedless approved as Shogra-1***' and have the potential to be cultivated on commercial scale in sub-tropical areas of the country including Khyber Pakhtunkhwa and Potohar

region of Punjab. On the basis of encouraging results obtained in terms of fruit Spot examination production and quality, a complete package of production technology has been developed at HRI, NARC. The technology developed by the scientists has special significance because early crop harvest would bring higher returns to growers.

Crop Improvement & Management

Establishment of Germplasm Unit (GPU) of fruit plants at NARC

Selected the site and prepared plots for establishment of GPU of different fruit plants (Fig, Peaches, Grapes, Plum, Apricot, Pear, Litchi, Citrus, Pecan nut, almond and Kiwi). Most of the available fruit varieties were planted in the foundation/evaluation block and some registered varieties were also planted in the multiplication blocks. Graft wood and bud wood of different registered varieties were collected from registered GPUs and grafted/budded on local root stock under the supervision of FSC & RD to produce true to type plants of the registered varieties.

Layout plan and plantation of plants in GPU

The True to type plants will be planted in the GPU. The map of the GPU has been prepared and ready for submission and registration from FSC&RD. The whole activities of the GPU were carried out under the supervision of FSC&RD.

Impact of hand thinning on the qualitative and quantitative attributes of peach

Manual fruit thinning was practiced in early maturing peach cultivars (Early Grand, Florida King, Spring Crest and Flam Crest), data revealed that small sized fruits (93.80 cm^3) were produced by the un-thinned plants leading to heavy fruit load (51.25 kg) and limb breakages that caused 20% fruit losses in the un-thinned plants. An equilibrium in terms of fruit volume (168.69 cm^3), weight (132.75 g), yield (42.00 kg) and TSS (13.03 ºBrix) was established when fruit thinning was practiced at 10 cm spacing, 5 days after petal fall. Quantity of marketable size fruits was increased in the thinned plants leading to consumer acceptability due to fruit size, color, taste and aroma**.**

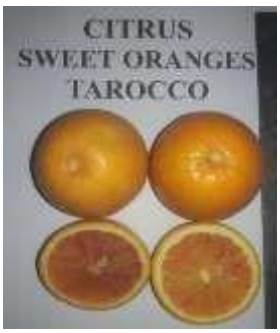


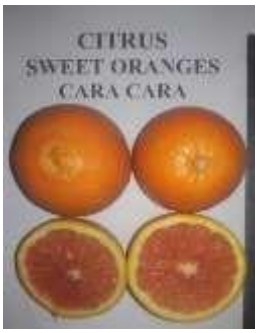

: **Fruit load management in peaches**

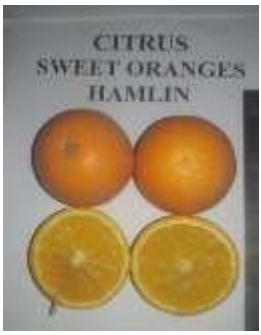
Evaluation of Citrus varieties and rootstocks under Pothowar Region

Evaluation of exotic citrus varieties *viz*., Arnold Blood, Cara Cara, Harvard blood, Rayan Navel, McMohan Valencia, Hockney, Tangor, Fremont, Beyenda Valencia, Kenan V, Caffin, Nules, Berri Valencia, Hamlin, Lane late, Atwood, Clementard, Handerson and Fisher and seven exotic rootstocks i.e. *Poncirus trifoliata*, Cleoptera mandarin, Troyer citrange, Carrizo citrange, Cox mandarin, C-35 citrange, Benton citrange including control (Rough lemon) are being carried out at HRI, NARC.

Citrus Varieties







<u>Evaluation of Kiwi varieties under Pothowar Region</u>

Eight varieties of Kiwi (*Actinidia spp*.) *viz*., Hayward, Hongyang, Hor 16A, Jinyan, *Actinidia argute*, *Actinidia farinose*, Allison and Bruno with their respective male varieties are being evaluated at HRI NARC**.**


Developmental Activities

Nursery Plants Production
Through Sexual means

- Guava = 2000
- Citrus Rootstock = 3000
- Loquat = 600
- Avocado = 2000
- Pecan 2000

Grapes

Guava

Kiw

Through Asexual means
Cuttings

- Grapes = 1000
- Mexican Lime = 2000
- Fig = 2000
- Sweet Lime = 1500

Loquat

Mexican Lime

Grafting/budding

- Citrus = 2000
- Peach = 3000
- Avocado = 400
- Plum = 700
- Apricot= 500
- Almond= 500

SweetLime

PecanNut

Avocado

Citrus

<u>Technology Dissemination/ Capacity Building</u>

- Provided services about fruit plant nursery, orchard, nutrient and diseases management to about 2200 Agricultural officers, Field Assistant, Extension workers, university students & farmers.
- Imparted three months training to graduates regarding "Fruit Plants Pruning, grafting Budding & Layering Techniques**".** Under PM's Youth Skill Development Program in Collaboration with NAVTTC & PATCO
- Training regarding orchard management and fruit load management was imparted to 50 beneficiaries

- Supervised B.Sc (Hons) thesis B.Sc.(Hons) (Internees) = 22 **Project developed/owned/implemented**
  - ✦ Developed = 20
  - ✦ Won = 03
  - ✦ Research Paper = 02

Construction of Green House under TIKA Project

Earned Project titled "Germplasm Acquisition for Fruit Crops Improvement and Establishment of Green-House for Handling of Germplasm and Mass-Scale Production of True to Type Fruit Plants" from Turkish Corporation & Coordination Agency (TIKA) Program Office, Islamabad and constructed a greenhouse under this project at fruit program, HRI, NARC)

Green House

Vegetable Crops Research Program

Research Activities

- **Standardization of Production Technology of two new Onion lines (NARC Onion -05 & NARC Onion-06).**

- The experiment was completed and the best results were obtained when the seedlings were transplanted in first week of January and planting geometry was kept as 10 x 25 cm for two new onion lines (NARC Onion-05 & NARC Onion06). Therefore the above described planting time and geometry is recommended for highest yield.
- Highest yield (19.4 t/ha for NARC Onion-05 and 21.0 t/ha for NARC Onion06) was depicted by the transplantation done on January 1st with the above mentioned plantation geometry (10 x 25 cm).

DEVELOPMENT OF HIGH YIELDING ADVANCE LINES OF INDETERMINATE TOMATO:

On the basis of the Preliminary Evaluation I & II (2020-2022); 05 round fruit shape advance lines viz; 04-08 27-2/2(8)(1)G-R*, 04-08 27-2/2(8)(4)G-R*, 07-08 9-7/8(8)(2) Ex. R*, 07-08 32-8/2(5)(2) V.G-R* & 07-08 32-8/2(5)(6) G-R* performed significantly high fruit yield as compared to the check hybrids and OPVs. However, 01 oblong fruit shape advance lines viz; Sahil 15-13/6-4 BFS; GOB* performed significantly high fruit yield as compared to the check hybrids and OPVs.

Pictorial views of fruits of advance lines of indeterminate tomato in F_8

Impact of different irrigation and mulching types on growth and yield of garlic NARC-HG1

The study was completed in 2023. The data was recorded for bulb yield and other morphological and agronomical characteristics. Results of this study showed that drip irrigation with combination of black plastic mulch had better growth and yield of garlic plants as compared to other treatments. Also, there was significant difference observed among different treatments as compared to control.

Yield per plot of 90 ft^2 was obtained 67 kg under drip irrigation with combination of black plastic mulch, whereas control treatment had 47 kg yield per plot.

Plastic mulch and Plastic mulch with drip irrigation.

Drip irrigation with straw mulch drip irrigation and surface irrigation.

Effect of variable methods of Zinc application on yield and quality enhancement of Tomato and Garlic

1st year activity for this experiment has been completed. The data was recorded for growth, yield and quality parameters of tomato and garlic. Results of this study showed that 0.2 % Zn foliar application and 10 kg ha^{-1} Zn soil application had better growth, yield and quality of tomato and garlic plants as compared to other treatments. Also, significant difference was observed among different treatments as compared to control.

Development of source population and pure lines in indeterminate tomatoes using double hybrids.

Selections from source population were made and 21 single plant selections and 18 bulk population selections were done. Seed was harvested manually, dried and packed with its label. Selections were done on the basis of fruit shape, plant stature,

leaf shape and yield per plant. Data regarding TSS, pH, length, width, weight/fruit, shelf life, TDS, locule per fruit and skin thickness were measured.

Evaluation and selection of indeterminate cherry tomato genotypes

Out of thirteen cherry indeterminate genotypes which were maintained last year, 6 promising cherry tomato genotypes were sent for first year NUYT through FSC&RD. A set of these genotypes along with other entries were also tested at VCRP, HRI, Islamabad and data were collected regarding yield, number of fruit/truss, plant height, fruit shape and fruit colour.

Cherry tomato genotypes Orange Cherry Tomato

Evaluation and selection of indeterminate beef tomato genotypes

Out of eight beef indeterminate tomato genotypes which were maintained last year, 5 promising genotypes were sent for NUYT through FSC&RD for first year. 2nd year NUYT and DUS will be conducted in following year through FSC&RD. A set of these genotypes along with other entries was also tested at VCRP, HRI, Islamabad and data were collected regarding yield, number of fruit/truss, plant height, fruit shape and fruit colour.

Beef tomatoes with different colour

Introduction of new vegetables

Basella genotypes were introduced in VCRP program and observations were made regarding flowering time, number of leaves and leaf colour. Later on, selections were made and coding was done for NUYT and material was sent to VRI Faisalabad, BARI Chakwal, Tarnab Peshawar, VRI Quetta and at VCRP Islamabad. Data will be recorded on different agronomical traits and yield.

Basella rubra plant with inflorescence

Breeding for hybrid and inbred line development in cucumber.

In the past different genotypes were crossed to develop F1 hybrids with the purpose to develop F2 (source populations). Currently we have five F2 populations from which selection will be made in the years to come and 2 S0 are available, which were selected on the basis of plant vigor and more number of female flowers. To develop more source population in 2023 different genotypes were allowed to openly pollinate. Seeds from these genotypes have been harvested and stored.

Different genotypes for open pollination.

Breeding in Okra

Crossing for the development of experimental hybrids and subsequently the development of source population has been started. A total of 72 hybrid crosses have been made and about 12 have been harvested.

Okra Crossing Scheme (Full Diallel)									
	Shehzadi	Pakeeza	Sabzpari	2302	Thai	Redseed	NOH03	2301	2303
Shehzadi	×								
Pakeeza		×							
Sabzpari			×						
23-02				×					
Thai					×				
Redseed						×			
NOH-03							×		
23-01								×	
23-03									×

Crossing process in Okra and Harvested seed

Potato Program, HRI, NARC

Research Activities

Evaluation of potato germplasm for yield & processing traits

Potato clones resistant against late blight and viruses were received from International Potato Centre, Lima, Peru for evaluation and selection as new varieties. These clones were multiplied by tissue culture techniques for micro tuber production. 12 clones were selected and through seed multiplication, basic seed of 12 clones was produced, 280 kg mini tubers of 35 clones were produced from local crosses which were done in Murree during 2014.

- 1300 kg mini tubers of 39 local crosses were produced during autumn, 2022-23 for further multiplication
- 700 kg basic seed of 12 CIP clones was produced for further multiplication
- 27 clones/varieties were evaluated for dry matter
- 700 kg seed of NARC Potato-II (CIP 393574-72) was produced
- 700 kg seed of NARC Potato-III was produced
- NARC Potato-I, NARC Potato-II and NARC Potato III have been multiplied in ample quantity
- 27 clones were evaluated for quality parameters
- 27 clones were evaluated for dry matter among them 09 clones having high dry matter traits and 06 clones having dry matter from 18.2 – 20.2 • 18 clones were evaluated for morphological parameters

Germplasm evaluation and harvesting

<u>Potato Adaptability/NUYT Varieties Evaluation</u>

The seed potatoes of 24 varieties imported by Private Seed Companies were received and tested for adaptability trial during spring, 2023 in the Potato Program, HRI, NARC, Islamabad. The varieties were coded by FSC&RD, Islamabad. Kuroda and Lady Rosseta were used as control. The trial was planted in

RCB design with four replications. Plant to plant & row to row distance was maintained at 20 cm & 65 cm respectively. Plot size was 3.9 m², standard agronomic & plant protection practices were followed to raise the crop successfully.

In spring 2019 trial, Maximum yield of 36.08 t/ha was observed in HZD11-3732 followed by Red Sky (34.21 t/ha) and GR-133-13-2 (33.93 t/ha) while the yield of other varieties ranged from 23.18 to 31.39 t/ha.All varieties received for testing were found better in yield. The crop was regularly sprayed with insecticide and fungicides to avoid disease and insect attack. All the regular recommended production practices were followed. All these varieties produced tubers in high proportion, yielded more than 20 t/ha, and have potential to get popularity among potato growers. The varieties which have completed two years of adaptability trial data were presented in VEC meeting to be released as variety for distribution in the country.

Data Recoding Exotic

Exotic Potato Trial

Studies on Processing Traits of Potato Clones/Varieties

27 clones were evaluated for dry matter among them 09 clones having high dry matter traits were selected for Crisp and 06 clones having dry matter from 18.2 – 20.2 were selected for French Fries. The selected material having better processing characteristics will be released as variety for processing industry after NUYT evaluation. The processing efficiency and quality of the end product is directly proportional to high dry matter content. If the dry matter content is too low, the French fries or crisp will be too soft or too wet, since more water is evaporated during processing.

National Uniform Yield Trial (NUYT) PRI, Sahiwal

Nine potato clones received from PRI, Sahiwal during autumn 2022-23 were evaluated for yield at Potato Program, HRI, NARC Islamabad. The highest yield 30.99 t/ha was recorded in clone NUYT-I followed by NUYT-D (25.38 t/ha) and NUYT-H (25.07 t/ha) respectively. Furthermore, the yield of other clones ranged from 14.31 to 24.05 t/ha.

Dry Matter Estimation using Hydrometer

Maintenance of Sweet potato clones:

Sweet potato propagated vegetatively

Cutting Preparation for multiplication

Transplantation of sweet potato

Sweet potato maintained under tunnel condition

Sweet potato maintained under tunnel condition

Seed Multiplication of Promising Clones

Potato Program HRI, NARC developed four clones, the seed of these clones have been increased for further evaluation in NUYT and other experiments. NARC Potato II (393574-72), 700 kg seed produced

NARC Potato III) 700 kg seed produced

2005-1 40 kg seed produced

Potato Promising Clones

		
NARC-2008 H**	**NARC 17-19 X Axona(10)**	**MF-1 X TPS-13**
		

Murato X Axona(17)	**Folva X Axona (1)**	**NARC 17-19 X Axona(19)**
		
Blue Denubi X Axona(11)	**Blue Denubi X Sarpomira (4)**	**Blue Denubi X Axona (10)**

	
Murato X Axona (1)	**SH-5 X Axona (7)**

- Advisory services were provided to visitors, grower and students
- 9 Internees from different universities were supervised
- 06 projects were submitted to ALP 10th badge and 04 were shortlisted among them for sending to referees

NATIONAL INSTITUTE FOR GENOMICS AND ADVANCED BIOTECHNOLOG

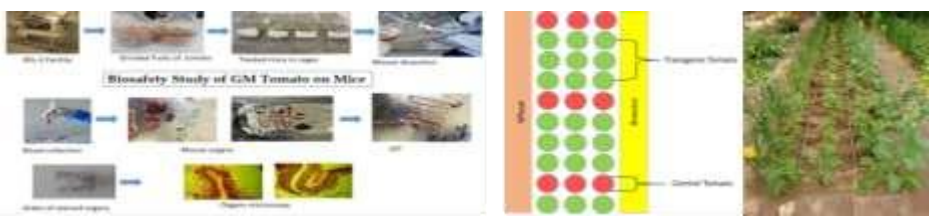
Transgenic Research Program

- Secondary metabolites were extracted through various methods from medicinal plant i.e. *Bacopa monnieri.* Their biochemical activities were also checked. Some useful compounds of BM would have play role in neuro protection.
- Genome wide identification of DEK/ERF and PERK gene families were find out in rice and tomato through various computational tools.
- Herbicide resistant gene (EPSPS) was transformed into two cultivars of chickpea. Transgenic chickpea were advanced to T3 generation under control condition and molecular evaluation confirmed the presence of transgene in each generation.

- First round of bio safety testing trials of transgenic cold tolerant tomato on environmental and health related aspects were performed successfully for assurance to ascertain their safety prior to commercialization. GMO testing of crop samples from DPP, Private Seed Companies etc. were completed.
- Strengthening of IPRs for NARS technologies project activities we have identified 18 cases of patents and 12 for PBRs.
- F2 population of 16 GSR lines were screened for Bacterial Late Blight (BLB) resistance and Brown Plant Hopper (BPH) resistance under controlled conditions. Promising tolerant lines were identified.
- Multilocation adoptability trails was conducted across all four rice zones. Based on grain quality and paddy yield, four GSR lines were submitted to National Uniform Yield Trial (NYUT) and same lines were submitted to FSCRD for DUS studies.

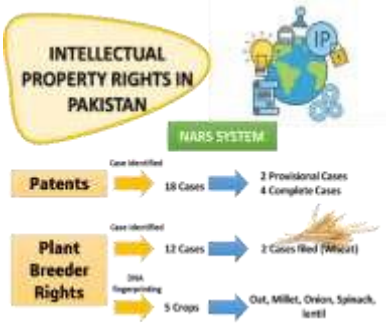
Rice farm activities at Muridkay Sheikhupura

- 2x sgRNA-Cas9 construct of StDMR6 was developed for co-expression of two sgRNAs and cassette was subcloned into the plant expression vector pCAMBIA1300 for Downregulation of StDMR6 gene for increased late blight resistance in Potato.
- Gene Specific Primers were designed and BBE gene were amplified from previously cloned pXCSG-mYFP-BBE vector for the development of Bacterial Expression system for Berberine Bridge Enzyme (*BBE*) Protein.
- StCHL1 gene sequence was retrieved from Data base and gene specific gRNAs; and SgRNA for *StPPO2* gene was designed; and transformed into the *Agrobacteriumtumefaciens* GV3101 for transformation purpose.



Biosafety testing of GM tomato (Health and environmental safety)

Development of herbicide GM Testing of crop samples resistant transgenic chickpea plants

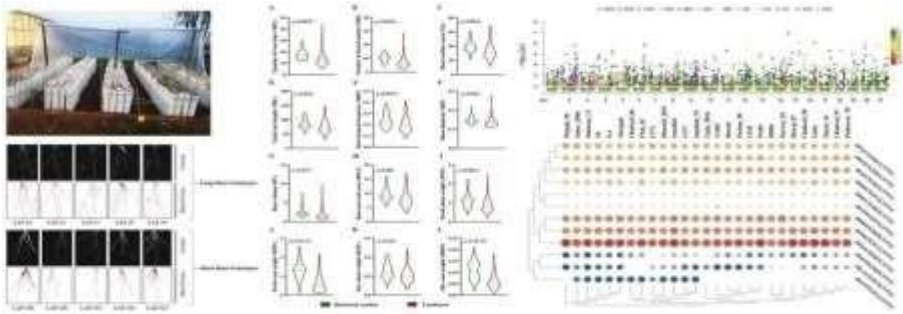


IPRs Identification and filing for NARS PERK gene family identification Technologies in tomato

Functional Genomics and Bioinformatics

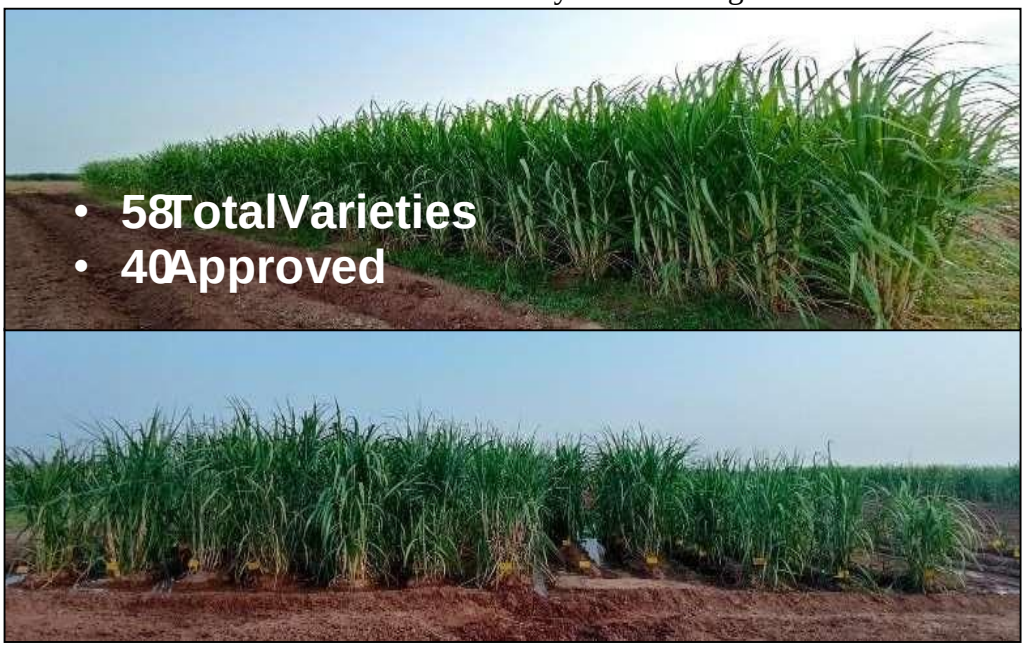
Genomic selection and genome editing in rice, wheat and sugarcane

Acquired/developed a total of 315 rice germplasm line, two lines with best yield, quality and BB resistant traits were selected for NUYT submitted to FSC&RD. In wheat selected 54 advanced lines for station yield trials. NGS data acquisition and analysis of association panel: DArTSeq genotyping (75K SNPs) of landraces association panel, Axiom genotyping (35K) of nitrogen association panel and Wheat 55K SNP array of historical association panel was performed.



TYGWAS for root architecture traits in land races panel of wheat.

In sugarcane acquired/developed fuzz of 88 crosses of advanced sugarcane lines from Guangxi University, China. CRISPR/Cas-9 mediated gene editing for Vacuolar Invertase to enhance sucrose biosynthesis in sugarcane.



SugarcanerepositoryatNIGAB,NARC,Islamabad

Genomic selection of livestock breeds for milk and meet traits

In livestock, total 158 samples of goat and sheep 9 breeds (6 sheep and 3 goat breeds). Overall 252 of all the livestock breeds were sampled, collected blood and phenotypic data. Genomic DNA extraction and its analysis.In tomato genome editing project for shelf-life enhancement CRISPR/Cas9 vector is constructed for targeting Vis1 (sHSP20) gene

Installation of ultra-high throughput NGS machine at NIGAB

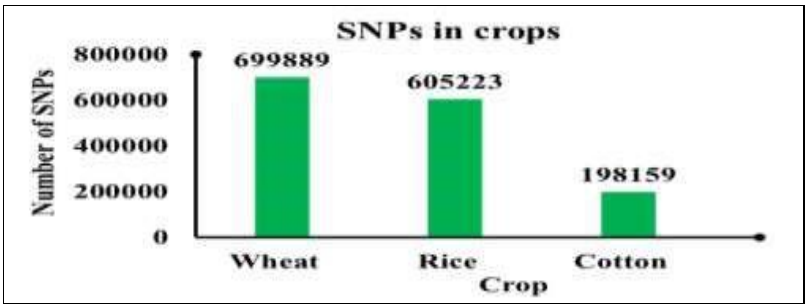
NIGAB has already acquired an ultra-high throughput DNBSEQ-T7RS NGS platform which is the biggest in South Asia.

DNBSEQT7-RS Next Generation Sequencing platform at NIGAB

Using bioinformatics tools, the whole genome sequence was chromosomewise screened and SNPs regions were identified and collected. MGI's ATOPlex platform for customized NGS library Prep kit.

PCR based NGS Atoplex Kit designing

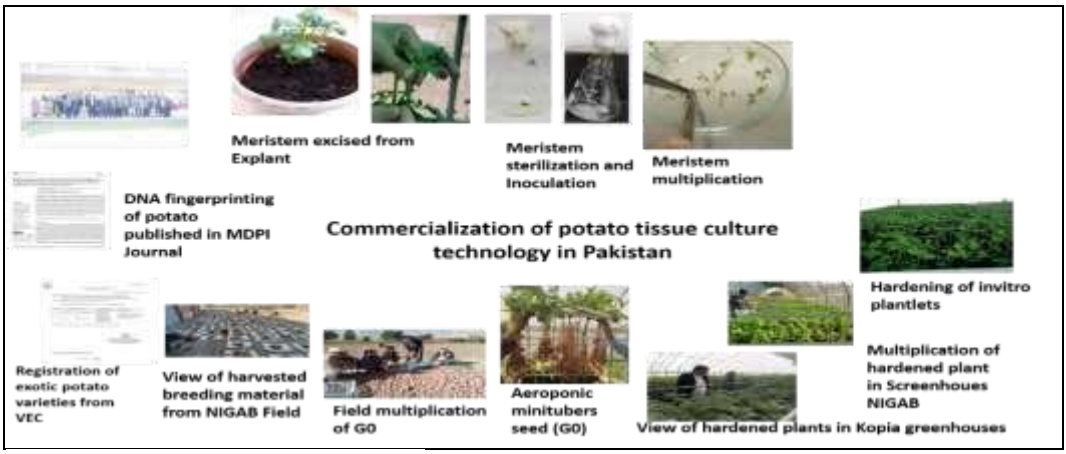
Using our software program, we have analyzed wheat, rice and cotton genomes. This is showing the completion report of crops genome processing related bioinformatics work.



Landscape of total SNPs number, identified in 12000 primers of 100 bp each in three crops named wheat, rice and cotton.

Plant Tissue Culture Program

- In commercialization of potato tissue culture technology project, harvested 167,638 **(G1)** virus free potato nucleus seed from Aeroponic and NIGAB Field and plantation of 70,000 **(G1)**material in screen houses of KOPIA and Field in Astore.



Pictorial representation of commercialization of potato tissue culture Technology in Pakistan

- Under potato varieties development through marker assisted selection (MAS) & speed breeding project, Potato germplasm of 28 parent potato varieties acquired from Potato Research Institute Sahiwal and Gansu Agricultural University Lanzhou, China.

Pictorial representation of varieties development through marker assisted selection (MAS) & speed breeding

- In micro propagation of elite ginger germplasm project, produced 20,000 in vitro plants and 20,000 plants were shifted for hardening at in NARC.
  4500plants were survived in hardening.

Invitro micropropagation of selected ginger varieties

View of invitro hardened plants

View of hardened plants in field NIGAB

In micro propagation of elite ginger germplasm and field evaluation

- In micropropagation of elite banana germplasm, through tissue culture 10,000 banana plants produced of NIGAB-1 and NIGAB-2. Rooted plants 8000 were shifted in Sindh Thatta for local multiplication and sale.

Marker Assisted Breeding Program

Screening of population for Stripe, Leaf and stem rust resistance genes

- Used 73 Egyptian wheat genotypes against 31 SSR Markers for screening (total of 50 markers) of Wheat rust Resistance genes

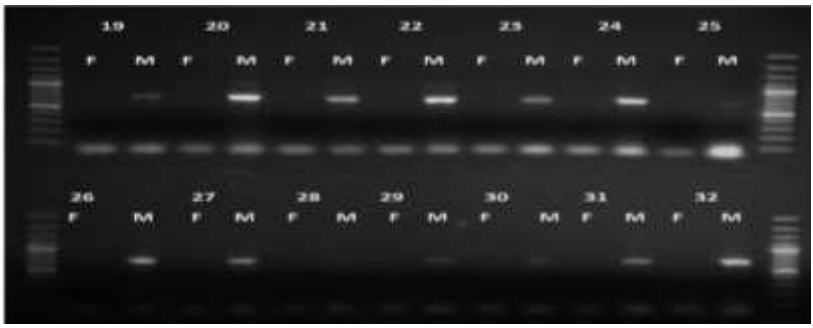
Stem (black) rust

Stripe (yellow) rust

Rust Diseases of Wheat

Identification of genetic diversity in Date palm samples against 40 SSR markers

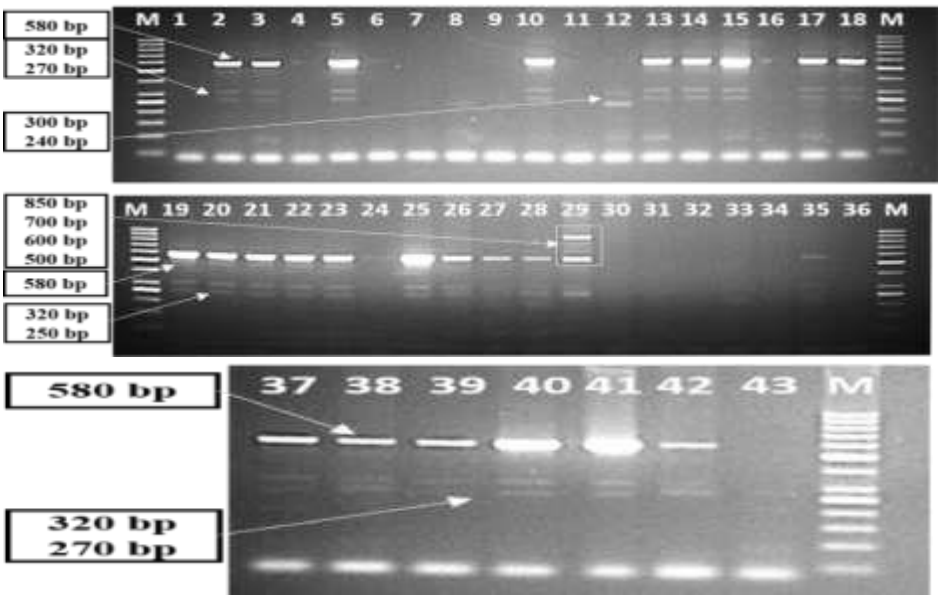
Screening of the 60 Date palm samples against 25 markers (total of 40 SSR Markers) give significant results



DNA marker identifying male plants and female plants of different Date palm varieties.

DNA Based Varietal Identification Of Fruit Plants For True To Type And Healthy Fruit Plant Nurseries

- So far, we have performed Polymerase chain reaction of 54 primers (19 INDEL, and 35 SSR) for 43 citrus varieties.



Primer Citcp-18 (Indel) 43 citrus DNA samples on 3% gel electrophoresis

Screening of Drought Stress Resistance Gene using Molecular Markers. Used 15 historical Wheat lines 9 SSR markers give significant results out of 15 Marker.

Animal Biotechnology Program

The Illumina Bead-chip 100K Bovine SNP Array of selected samples from Sahiwal & Tharparker cattle was performed. A total of 168 SNPs were identified. GWAS analysis was performed and found potential SNPs on different chromosome were identified for marker development.

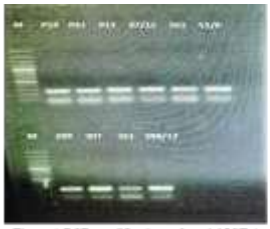
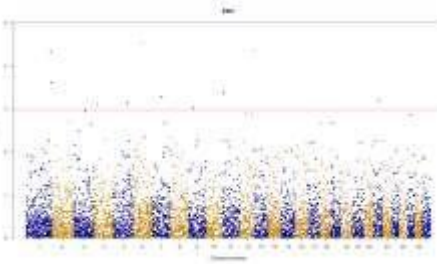


Figure 4. PCR amplifications of partial IGF-1 gene of 249 bp on 1.5% agarose gel

Figure 5. PCR amplifications of partial OPN gene of 290 bp on 1.5% agarose gel



Distribution of marker FST values across the chromosomes using Manhattan plot

- Developed i-ELISA by using local stains of PPRV. Developed/ optimized protocols regarding Hybridoma development, analysis and freezing etc.

Development of Hybridoma for monoclonal antibody production

- Last year another viral disease of animals named as Lumpy skin Disease (LSD) virus was isolated as a first step towards vaccine production against LSD.

<u>Indigenous Yeast Extract Products</u>

- Successfully identified and characterized the diverse range of indigenous yeast strains (n=20) that can be used as an alternative to commercially available yeast. Isolation and characterization of microbes of FAO/WHO approved, WGS characterized microbial strains (n=20) available for development of indigenous feed/ food products.

Step wise preparation of local yeast extract from YNIGAB

RUNNING PROJECTS IN NIGAB 2023 16 Nos

CROP DISEASES RESEARCH

Screening of NUYT and advanced lines against diseases

Rice

Screening of NUYT: Fifty-six OP rice varieties (36 fine and 20 course) and 140 rice hybrids were screened against bacterial blight (BB) of rice. The

Fig1 Data scoring and response of rice germplasm against *X. oryzae* pv. *oryzae*

disease response was evaluated according to the standard evaluation system for rice. Out of 36 fine rice lines, 02 lines showed resistant/moderately resistant response. Out of 20 course lines 07 were resistant/moderately resistant. Out of 140 hybrids, 30 were resistant/moderately resistant. Contributed disease data of 14 released rice hybrids and 06 Op varieties.

On hundred and thirteen rice advance lines (46 advance lines and 67 GSR lines) from the rice program, NARC was screened against BB. Twenty-two advance and 40 GSR rice line were resistant to BB.

Wheat

Analysis of NUYT 2022-23: None of the wheat lines in NUYT 2022-23 was found resistant to all three rusts. Among 80 only three lines were found effective and showed Relative resistant Index 6 and above. Six candidate lines were found resistant to yellow rusts and 12 to leaf rust only.

Analysis of National Wheat Disease Screening Nursery 2022-23: Fifteen locations data revealed that only five lines were found resistant to all three rusts and 52 to leaf and stripe rusts. Only two lines showed their effectiveness to leaf and stem rusts. Seventy-five lines were found resistant to stripe rust, 157 to leaf rust and 5 to stem rust only.

Status of the historical Lines: Data of 23 locations revealed that the dominant wheat variety Akber-19 was found effective against all the rusts across the

country. Faisalabad-2008 and TD-1 the other dominant wheat varieties were found susceptible to rusts. Newly released wheat varieties were found resistant to rusts.

Monitoring of wheat rust situation through trap nurseries: Twenty three locations showed the effectiveness of yellow rust resistant genes *Yr5, Yr10, Yr15, YrSp* and *Yr36*. Similarly, leaf rust resistant genes *Lr3Ka, Lr19, Lr10,27+31* (Gatcher) and Lr28 were found effective to leaf rust. Stem rust resistant genes *Sr31* still effective in Pakistan.

PEST MANAGEMENT

Monitoring of rice diseases and collection of disease specimens

One rice survey was conducted in Punjab. Due to the flood and law and order situation, surveys were not conducted in Sindh and KP. In Punjab, 40 rice fields were surveyed. The status of bacterial blight (BB), rice blast, brown leaf spot and other minor diseases was recorded. In Punjab Sialkot/Narowal, Gujranwala, Sheikhupura, Faisalabad, and Hafizabad were surveyed. BB incidence was 40%,
37%, 40%, 0%, and 17% respectively. The incidence of brown leaf spot in Sialkot / Narowal, Gujranwala, Sheikhupura, Faisalabad, and Hafizabad was 57%, 56%, 15%, 2%, and 18% respectively; blast incidence was 4% in Gujranwala and 7 % in Narowal, false smut incidence was 5% in Narowal and sheath blight incidence was 11% in Gujranwala, 10% in Narowal (Fig. 2).

Evaluation of chemicals against bacterial blight of rice

Fig. (A) False smut of rice, (B) Rice Blast (C) Bacterial blight of rice (D) Stem rot or rice

Evaluation of eight chemicals in field conditions was performed by artificial inoculation with the most virulent *Xoo* isolates on Super Basmati. Twofactor factorial experiment in Randomized Complete Block Design (RCBD) with three replications was done. All the recommended agronomic practices were adopted during the experiment. Chemicals were tested for their preventive (preinoculation (4 and 14 days) application) and control (post-inoculation (4 and 14 days) application) efficacy. Inoculation was done by the leaf clipping method at the maximum tillering stage. Data on lesion length and disease severity were recorded 21 days after

inoculation. The lowest disease severity (27%) was recorded with Oxost when applied as preventive treatment followed by BN-Zole (as preventive).

Estimation of rice yield loss due to bacterial blight

The experiment was carried out in CDRI field during the rice growing season, 2022–2023. Two rice varieties Super Basmati as susceptible and Super Gold as moderately resistant variety were used for yield loss estimation under artificial bacterial blight (BB) inoculation. Twenty-five to thirty days old nursery plants were transplanted in experimental plots. All the recommended agronomic practices were adopted during the experiment. The experiment was laid out in Complete Randomized Block Design (CRBD) with eight treatments and three replicates. Plants were inoculated at different growth stages. BB inoculation was done at Maximum Tillering (MT), Panicle Initiation (PI), Booting stage (Bt) and Flowering stage (Fl). BB inoculation is also done in three different combinations like MT+PI, MT+PI+Bt and MT+PI+Bt+Fl. Plants were inoculated with 24 hours old culture of the most aggressive *Xoo* isolates (P-10 and P-18) by leaf clipping method. Disease scoring was done 21 days after inoculation (DAI). Disease severity was high in Super Basmati than in Super Gold. Disease severity ranged from 00-59.85 % in Super Basmati and 0.0 -10.53% in Super Gold. According to the results maximum disease severity (59.85%) was recorded when inoculation was done at the Maximum Tillering stage while minimum disease severity (14.32%) was recorded at PI stage inoculation treatment in Super Basmati. The yield ranged from 1.80- 2.74 t/ha in Super Basmati. The lower yield was recorded in Super Basmati when inoculation was done at MT, MT+PI, MT+PI+Bt and MT+PI+Bt+Fl. The yield loss pattern in Super Basmati indicated that BB inoculation at any stage has a considerable effect on yield reduction except flowering stage. Maximum yield reduction was observed when the disease comes at maximum tillering to the Booting stage.

Fig. DG NARC and Member PSD visiting yield loss trials at BB at CDRI field

Virulence/ A virulence analysis of leaf rust of wheat samples

Avirulence/virulence data was recorded from ten leaf rust differential sets. Leaf rust-diseased samples received in the 2022-2023 wheat cropping season were cataloged and processed for the revival of rust (continued seasonal activity). Revived leaf rust isolates were inoculated on morocco plants for inoculum multiplication followed by virulence analysis. Stem rust local race RRTTF was inoculated for fresh inoculum multiplication (Continuous seasonal activity).

Mitigation of Aflatoxin in chilies funded by USDA/ USAID through CABI

In order to check the efficacy of biopesticide; AflaPak in the chili fields, fifteen fields were selected. In nine fields AflaPak was applied whereas six fields were kept as control. AflaPak was applied fifteen days prior to flowering with adequate moisture in the field. The rate of application was 4kg per acre and all the other interventions like the addition of fertilizers, weeding etc were halted for two weeks after the application.

Sampling of chilies from fields

Fifteen chili samples were collected from selected fields of Sindh. All samples were not collected at the same time. Nine samples were collected in September while six samples were collected in October. Samples were checked for moisture content and were dried at 60˚C in the oven for 2-3 days until the moisture level reached 5 percent. Samples were grounded with the mechanical grinder and stored in labeled falcon tubes.

Quantification of Aflatoxin contents

For quantification of aflatoxin content in each chili sample, ELISA was performed. It was observed that with the exception of two chili field samples, all samples recorded aflatoxin content within permissible limits ranging between 0.13-6.67 ppb. Resampling was done from eight chili fields in the month of December to compare the variation in the aflatoxins content of chili. However, it was noticed that all samples recorded lower aflatoxins content ranging between 0.837-7.37ppb and no significant increase was observed with passing months.

Isolation of *Aspergillus flavus* from chili samples

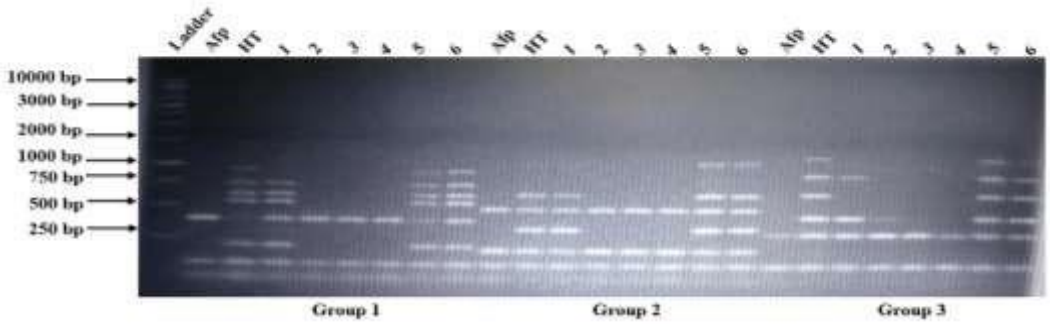
Total of one hundred ninety-two colonies of *Aspergillus flavus* were picked from CU media and one hundred ninety-two single spores isolations were done. They were purified, preserved for further use, and subsequently DNA of all isolates was extracted and subjected to CAP analysis.

Cluster Amplification Pattern (CAP) Analyses

Cluster amplification of one hundred ninety-two chili isolates was done for the screening of atoxigenic profile by using different primer sets such as Group 1 (AC06, CC02, AC09, AC01, AC11, AC03, IC02), Group 2 (AC07, CC03, AC10, AC02, AC13, AC05) and (CC01, AC08, CC04, AC12, AC04, CC04).

Identification of atoxigenic strains

For the determination of deletions in *A. flavus* isolates CAP analysis was carried out. Eighteen markers comprising aflatoxin (AC01-AC13) and cyclopiazonic acid (CC01-CC04) clusters were aggregated into three groups. Out of 192 isolates analyzed for aflatoxins cluster deletion, 24 isolates showed deletions having similar patterns.

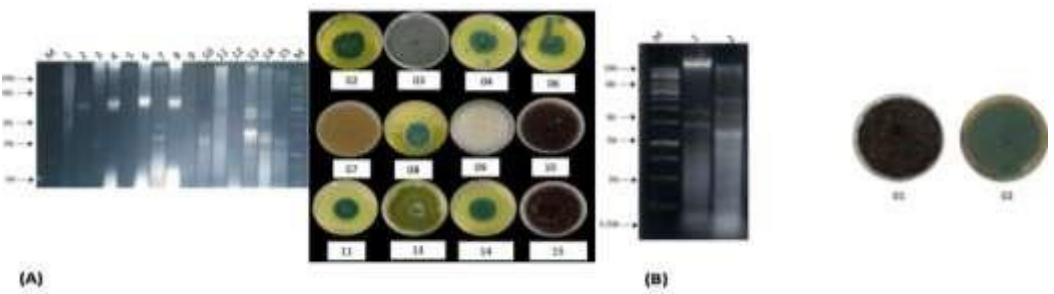


Gel electrophoresis showing deletions in cluster amplification pattern of different isolates including toxigenic and atoxigenic strains.

Salient achievement: Atoxigenic strains were identified in the lab and also trials are underway to check the efficacy of the first-ever Bio-pesticide for mitigating aflatoxin in chilies and if successful will help boost the exports of the country.

<u>Identification of mycoviruses and molecular characterization</u>

Two hundred and ninety seven fungi were isolated and preserved from soil samples collected from chili and maize fields. Total nucleic acid extraction of 297 fungal cultures were carried out to detect mycoviruses and **fourteen mycoviruses were identified**.



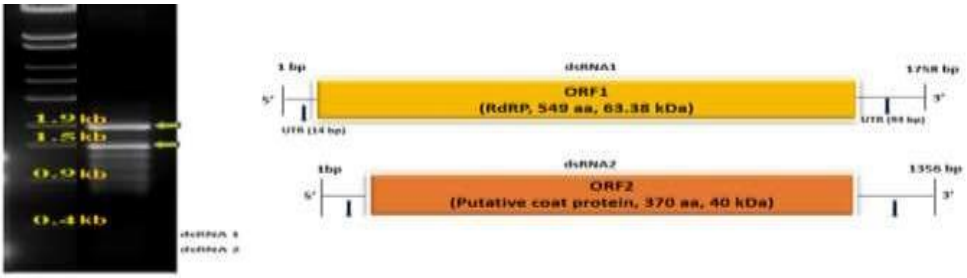
Agarose gel showing different profiles of mycoviruses

Lane 1 indicates 1kb ladder, Lane 2,4,6,7,8,9,10,11,13,14,15 shows presence of mycoviruses. All positive cultures (On right). 2- Aspergillus spp., 3- Aspergillus fumigatus, 4- Penicillium crustosum, 6-Penicillium goetzii, 7- Paecilomyces variotii, 8- Penicillium rubens, 9- Hypoxlon spp., 10- Unidentified, 11- Penicillium chrysogenum, 13- Aspergillus flavus, 14- Penicillium spp., 15- Unidentified (B) Agarose gel showing two different profiles of mycoviruses. Lane 1 indicates 1kb ladder, Lane 2 and Lane 3 shows mycoviruses from isolate 1 (unidentified fungi) and isolate 2 (Aspergillus fumigatus)

Two mycoviruses from Paecilomyces variotii and Talaromyces pinophilus were **molecularly characterized.**

Paecilomyces variotii

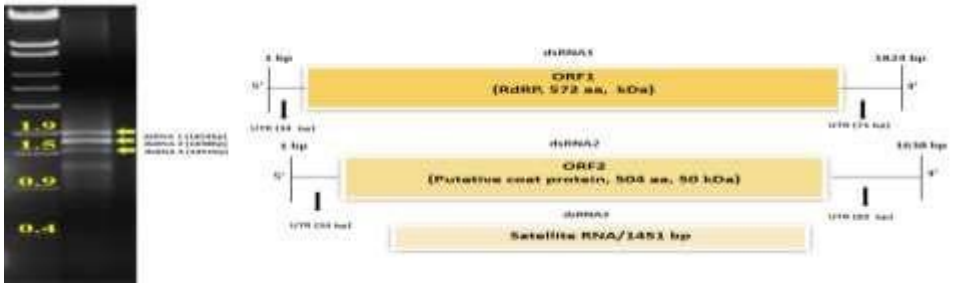
The mycoviral infection of P. variotii with a dsRNA virus, P. variotii partitivirus-1 (PvPV-1) in the family Partitiviridae was **reported first time.** The fungus P. variotii contained 30 nm icosahedral virus particles with two dsRNA segments of 1758 bp and 1356 bp long.



- Genome organisation of *P. variotii* partitivirus-1 (PvPV-1) along with dsRNA profile on the gel showing the size of both segments.

Talaromyces pinophilus

- The mycoviral infection of *T. pinophilus* with dsRNA virus, *T. pinophilus* partitivirus-1 (TpPV-1) in the family *Partitiviridae* was reported for the first time. The *T. pinophilus* contained 35 nm icosahedral virus particle, with three segments which are 1824 bp,1638 bp and 1451 bp long.



- Genome organization of *T. pinophilus* partitivirus-1 (TpPV-1) along with dsRNA profile on the gel showing the size of all segments.

Salient achievements:

This is the first report of both these viruses being identified and molecularly characterized from these fungi.

Status and Incidence of Potato viruses infecting tomato in Pakistan

It was found that potato viruses PVY, PLRV & PVX were abundant in major tomato growing areas (Table 1) and in most of the surveyed areas the tomato and potato crops were either growing side by side and yet in some areas potato was being sown on the fields freed after harvesting of tomato crops. Proper sanitation and management practices are needed to be implemented by the growers before the viruses reach the economic threshold level in tomatoes and start degeneration in tomatoes. The losses in potatoes from the above-mentioned viruses can considerably be lowered if the virus doesn't survive in the tomato crop for the next seasons.

Province-wise disease incidence of potato viruses infecting tomato

Virus	Incidence (%)		
	Khyber-Pakhtunkhwa	Punjab	Sindh
PVY	22%	25%	12%
PLRV	10%	10%	24.7%
PVX	15%	7%	4%

Preliminary studies on root-lesion nematode (RLN) (*Radopholous spp*) associated with wheat crop in Pakistan

The root lesion nematodes (*Pratylenchus neglectus and P. thornei*) are major pathogen of cereals in many regions worldwide. Wheat genotypes resistance to these nematodes can be determined from final nematode population densities in controlled environmental chambers or glass house. To assess the prevalence of root lesion nematodes in the wheat experimental field area of the National Agricultural Research Center, Islamabad, soil samples along with wheat seeding of fifty-seven historical wheat genotypes were collected in 2022. The nematode species *P .neglectus* was found in all the wheat genotypes associated with roots as well as in root rhizosphere. For fields having root lesion nematodes in 2022, *P. neglectus* mean population densities were found Margalla variety with maximum nematode population (2033/100gr) of soil, followed by wheat varieties as Markaz19 (1446/100grams), Bakhtawar (1320/100gr), Suleman-96 (1140/100grams), Johar-16

(1053/100grams), Pastor (1040/100grams), Zinkol-2016, a zinc fortified wheat variety (1026/100grams) and WL711 (1000/100grams). Stunt nematodes (*Tylenchorhynchus spp*) were also detected from all the root rhizosphere in association.

TECHNOLOGY TRANSFER

Training

- Various training's conducted for the purpose of dissemination of technology under the project "Regulatory Harmonization in Pakistan for MRLs and Biopesticides" are as follows
- Scientific staff of AZRC on 11th August, 2022
- Academia of the University of Karachi and Federal Urdu University of Arts, Science & Technology, Karachi on 8th September, 2022
- Academia and students of Sindh Agriculture University, Tandojam on 27th September, 2022
- Academia and students of Jinnah University of Women, Karachi and Mohammad Ali Jinnah University, Karachi on 6th October, 2022
- One-week training was conducted in Aflatoxin Biocontrol Laboratory, CDRI, NARC, for CABI representatives from 6th to 12th December, 2022.

Visit of Dignitaries to Aflatoxin Bio-control Laboratory

Visit of delegates (USAID, USDA and CABI) from stakeholders engagement workshop on Regulatory Harmonization in Pakistan for MRLs and Biopesticides to 'Aflatoxin Bio-control lab' on February 14, 2023.


Visit of Maria A. Longi, Deputy Assistant Administrator from USAID to 'Aflatoxin Bio-control lab' on September 6 ,2022

Institute of Plant and Environmental Protection

Introduction

Agriculture produce is susceptible to a range of vertebrates and insect pest infestation causing both pre and post-harvest losses of about 30-50%. To safeguard the crop from the ravage of these insect pests, synthetic pesticides are tremendously used in agro-ecosystem. These pesticides may or may not be doing their indented job but unquestionably imprint adverse implications on environment, biodiversity, human health and international trade. Therefore, it is imperative to monitor these toxic chemicals from field to fork and devise environment friendly products and sustainable strategies to minimize crop losses and conserve biological resources. The Institute of Plant & Environmental Protection (IPEP) was created under a comprehensive re-structuring exercise of Pakistan Agricultural Research Council. The following four Programs of IPEP are working in close coordination to achieve theses multifaceted goals.

- Ecotoxicology Research Program (ERP)
- Vertebrate Pest Management Program (VPMP)
- National Insect Museum Program (NIMP)
- Insect Pest Management Program (IPMP

ERP

- All the requirement of PNAC were fulfilled and thus ERP attained the status of ISO17025:2017 accreditation for another year.
- Supervised field trials on chili on the dissipation of profenofos were conducted at UmerKot, Kunri and Mirpurkhas in collaboration with CABI. The concentration of profenofos was below its CODEX MRL in chili even before its recommended PHI of 7 days. Moreover, there is a minimal human health risk associated with consumption of chili grown under good agricultural practices.
- A total of 80 and 69 percent of brinjal (n = 25) and cauliflower (n = 26) samples were found contaminated, respectively. Sixty-five percent of cauliflower samples were found non-compliant with both European Union (EU) and Codex

Alimentarius Commission (CAC) maximum residue limits (MRL), while 20 % of brinjal samples were found to be non-compliant with EU-MRL. Both vegetables contained high levels of the androgen antagonist chlorpyrifos and the thyroid hormone inhibitor cyhalothrin-lambda posing human health risk.

- Field and market samples of tomato from Dir & Swat areas of KPK were analyzed for pesticide residues. About 59% of total samples were found to be contaminated with fourteen different pesticides. Around 7.8% of the total samples were found to be non-compliant with the EU-MRLs. The most frequently detected pesticides were imidacloprid (detected in 12 samples) and tebuconazole (detected in 10 samples), while the pesticides exceeding the EUMRLs were chlorpyrifos, metalaxyl, pyraclostrobin, tebuconazole and thiamethoxam.

NIMP

- National Insect Museum (NIM) houses and curates about hundred thousand insect repository. This year more than 400 insect specimens were added to this repository. Phylogenetic trees of 17 species have been prepared on based on DNA identifications. Twenty insect specimens were identified for different universities and research organization. Approximately 500 visitors were received and briefed and twenty students conducted their BS, Masters, and PhD research at NIM.
- Contrary to the reports, we could not find any outbreak of an invasive pest, *Tuta absoluta*, in Islamabad and southern districts of Punjab.

IPMP

Integrated pest management (IPM) strategies involving screening of germplasm for resistance against insect pests, nutrient management, biological control, and development of biopesticides were undertaken.

- Under induced infestation of pests and monitoring by electrical penetration graph (EPG) system evaluation of wheat and rice entries included in NUYT 2022-23 trial showed resistance against aphids except for one entry.
- The neem-coated urea treatment as compared to the regular urea fertilizer consistently exhibited lower aphid populations in wheat, with the lowest population observed during the crop maturity stage.
- Two bacterial strains isolated indigenously showed promising mortality in the rice leaf folder.
- Molecular biopesticide involving the dsRNA targeting the Fer1, Fer2 genes, and their combination (Fer1 + Fer2) treatments exhibited as high as 98% mortality in brown plant hopper.

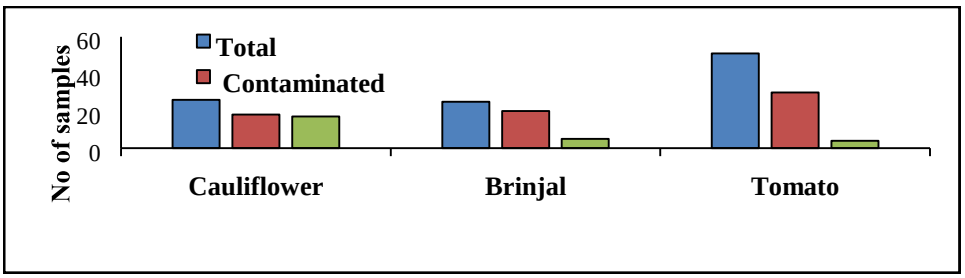
- In wheat crop the population of aphids has significantly been decreased and the yield increased by 11% through intercropping with brassica for the conservation of biological control agents. (Fig. 3, 4)
- In rice crop the Trichogramma chilonis along with granule insecticide reduced the infestation of borers to 3% in comparison with 12% in check plots.
- In vive maximum parasitism of rice leaf folder (RLF) eggs by T. chilonis was observed at 12 h of the age of eggs.
- Approximately 70% cost reduction in fruit flies management is expected by combined use of the male annihilation technique (MAT) and the sterile insect technique (SIT). For the simultaneous application of these techniques, the reduced response of sterile males to methyl eugenol and the inadequacy in its delivery system are the limiting factors. Hence development and validation of ME delivery system (aromatherapy) for peach fruit flies Bactrocera zonata (Diptera: Tephritidae) management is under progress.
- The molecular approach RNAi was adopted to suppress the B. dorsalis male attraction to ME. The Odorant receptor co-receptor Orco gene is reported to be upregulated by ME feeding in Bactrocera dorsalis. The double-stranded RNA (dsRNA) of Orco was prepared and the males were fed on dsRNA at 5d of age. The dsRNA-fed males had significantly reduced attraction to ME traps than the untreated males.

VPMP

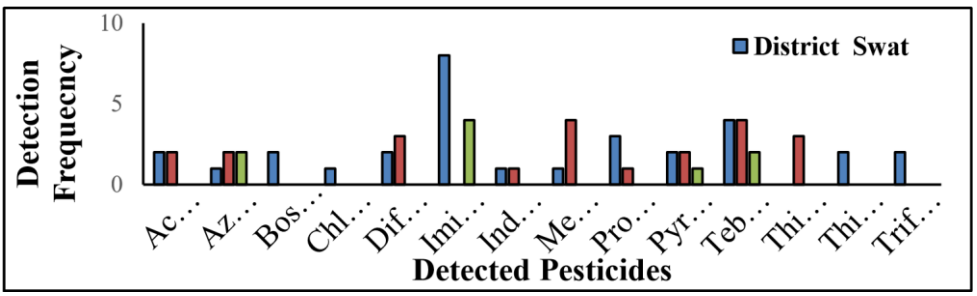
- Wild boar (Sus scrofa) is a notorious vertebrate pest that causes huge economic losses to standing crops. Novel approaches has been evaluated and adopted for its monitoring and mitigation.
- Waste lubricant (used motor engine oil) has been demonstrated to attract wild boar to baiting station 19 times more than the control. Moreover, they also leave behind blue prints of their activities on oily soil surfaces. Thus the waste engine oil can be used for the monitoring and successful management of wild boar in an area.
- Sodium nitrite ($NaNO_2$) is highly toxic to wild boar as they lack the detoxifying enzyme, methemoglobin reductase, in their bodies. However, its bitter taste makes it spiteful for the animal. To mask this pungent taste, sodium nitrite (10%) in maize based pellets, were coated with emulsion of lecithin, polyethylene glycol (PEG) and glycerin for the first time in Pakistan. This encapsulated product have demonstrated promising results in wild boar management strategies.

Pictures & Figures

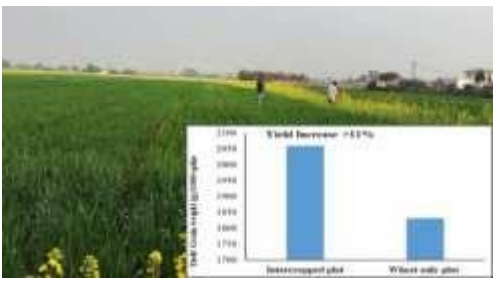
Dr. G.M. Ali, Chairman PARC, and participants of the workshop "Regulatory Harmonization in Pakistan for MRLs and Biopesticides" visiting Pesticide Residues Lab., ERP, NARC.

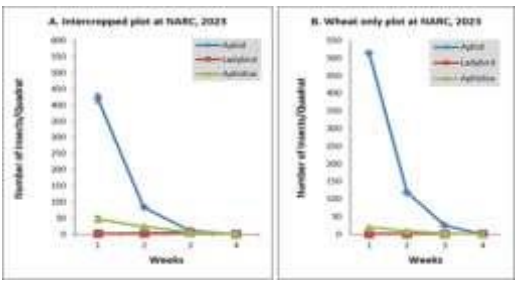


Status of pesticide residues in cauliflower, brinjal and tomato



Pesticide residues detected in tomato samples collected from Swat, Dir and Islamabad





Intercropping of Brassica with the Intercropping of Brassica with the Wheat Wheat crop enhanced the yield of crop significantly reduced aphids and wheat due to the biological control of increased the biocontrol agents
aphids population in the field at NARC

Mircoencapsulated formulation of Sodium nitrite for wild boar control

National Sugar and Tropical Horticulture Research Institute(NSTHRI)Thatta

Following R & D activities on sugarcane variety development and other crops were successfully implemented. The results of each activity are summarized as under:

Sugarcane Variety Development Activities

Sugarcane genotype selected for NUVYT study

The promising sugarcane line Thatta-1909 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). Furthermore, the seed of the promising sugarcane lines of the institute viz Th-1970 and Th-1822 has been sent for further multiplication and evaluation in NUVYTs (2022-23 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

Maintenance of National and International sugarcane germplasm for flowering study: During the reporting period in sugarcane germplasm a total of 262varieties/lines of were planted for flowering study and fuzz collection, at Makli experimental farm, Thatta. Out of total, 71 were booted, 67 had complete flowered and 3356 gram true fuzz was collected from the same sugarcane varieties.

Maintenance of sugarcane crossing block for quality fuzz production: Total 13 matching flowering behavior parental lines of sugarcane were maintained at Makli farm for the purpose of quality fuzz production under field conditions. At the time of flowering initiation, the flowers of the different parental sugarcane lines were covered with crossing bags till seed setting period and collected 164 g of sugarcane fuzz.

Collection, drying and storage of sugarcane fuzz: Total 13 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:

Fuzz nursery was maintained and developed 10500 sugarcane seedlings from locally collected Polly-Fuzz and bi-parent crosses.

Evaluation and selection of sugarcane clones/genotypes:

In different variety evaluation trials of the cropping year 2021-22, a total of 366, 185, 187, 14, 12, 6 and 3 sugarcane clones/genotypes were maintained in single plant trial, 1st cycle, 2nd cycle, 3rd cycle, 4th cycle, preliminary yield trial, advanced varietal trial, NUVYT first and second plant crop, respectively. 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 2022-23. The progress of all sugarcane variety evaluation trials is as under.

- **Single plant trial:**
  Total 2658 seedlings were maintained. Out of the total single plants, 622 were selected and shifted to 1st cycle.
- **First cycle:**
  A total of 230 clones were maintained. Out of the total clones, 65 were promoted and planted in 2nd cycle.
- **Second cycle:**
  A total of 187 clones were maintained in 2nd cycle. Out of the total clones, only 14 (29.16%) were promoted and planted in 3rd cycle.
- **Third cycle:**

A total of 14 genotypes were evaluated as 3rd cycle. Out of the total genotypes, seven genotypes i.e. Th-2201, Th-2202, Th-2209, Th-2210, Th2211, Th-2212 and Th-2213 were promoted and planted in 4th cycle.

- **Fourth cycle:**

  Total 12 sugarcane genotypes i.e. Th-2107, Th-2111, Th-2112, Th-2113, Th2114, Th-2120, Th-2121, Th-2124, Th-2126, Th-2127, Th-2129 along with Th-2109 as check variety were evaluated in 4th cycle. Out of total, six varieties viz. Th- 2107, Th-2108, Th-2112, Th-2120, Th-2124 and Th-2126 were selected and promoted to preliminary yield trial for further evaluation.

- **Preliminary yield trial:**

  Total 6 promising sugarcane genotypes, i.e. Th-2009, Th-2016, Th-2026, Th2041, Th-2042, Th-2043 along with check variety Th-2109 were maintained at NSTHRI, research site. Th-2009, Th-2026, Th-2041, Th2042 and Th-2043 were selected and planted for further testing and evaluation in advanced varietal trial

- **Advanced varietal trial:**

  performance of 03 promising sugarcane genotypes i.e. Th-1909, Th-1970 and Th-2042 developed from local fuzz along with Th-2109 as check was tested in advanced varietal trial at NSTHRI research site (Makli farm) Thatta. The genotype Th-1909 was selected and promoted to NUVYT.

- **NUVYT First plant crop:**

  Total 9 sugarcane varieties were maintained in NUVYT trial at NSTHRI research site (Makli farm) Thatta. Sugarcane lines YTTH-1705, CPFG-402 and SLSG-109 produced maximum mean cane yield of 137.50, 117.08, 110.42 t ha^{1}, respectively against the check varieties Th-2109 and Th-10 which produced mean cane yield of 104.58 and 97.17 t ha^{-1}, respectively.

- **NUVYT second plant crop:**

  Total 9 sugarcane varieties were maintained in NUVYT trial at NSTHRI research site (Makli farm) Thatta. Maximum mean cane yield of 127.08 was obtained from line CPTJ-27 followed by PSR-07-45, CP-00-1101 and CPFG434 with mean cane yield of 116.25, 115.00, 107.92 t ha^{-1}, respectively against the check varieties Th-2109 and Th-10 which recorded mean cane yield of 104.58 and 97.17 t ha^{-1}, respectively.

- **Seed increase trial:**

  During the reporting period, 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, HoTh409, 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.

Sugarcane quality analysis in the lab.

During the reporting period 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 genotypesTh-2121, Th-2114, Th-2113 and Th2124were found better in sugar content.
- In fourth cycle Th-2043, Th-2042 and Th-2026 were better in terms of CCS.
- In Preliminary yield trial Th-1970 and Th-1909 were better in terms of CCS%.
- In advanced varietal trial Th-1822 was better in CCS%.
- In NUVYT First plan t crop sugarcane lines CP-00-1101, SLSG-157, CPTJ-27, PSR-07-45, SLSG-128 and SLSG-21were identified as high sugar content varieties. In NUVYT second plant crop sugarcane lines S-2012-SL-426, SLSG-1591, S-2003-US-778 and SLSG-153 exhibited better performance with respect to CCS%.

Screening and monitoring against different 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 6.38-12.04 in evaluated sugarcane genotypes. The genotype HS-240/10 remained highly susceptible and HS240/4 and S-232/18 was susceptible to borer complex infestation. While, remaining all genotypes had less than 8.00% infestation.
- **Fourth cycle:**
  The mean borer complex infestation in sugarcane genotypes was in range of 5.46-8.60%. All the genotypes were less susceptible to borer complex infestation.

- **Preliminary yield trial:**
  The borer infestation was found in range of 4.76-9.20% in all assessed sugarcane genotypes. Only one genotype Th-2042 was found susceptible.
- **Advance varietal trial:**
  The mean borer complex infestation was in range of 7.07-8.21% in all evaluated sugarcane genotypes.
- **NUVYT (New plant crop):**
  Mean borer complex infestation was found in range of 6.06-9.84%. Only one sugarcane variety CPFG-307 was found moderately susceptible.
- **NUVYT (2nd plant crop):**

Mean borer complex infestation was found in range of 6.35- 9.70%. Only one sugarcane variety SLSG-157 was found moderately susceptible.

Other activities

- **Multiplication Banana through Winrock PAD International project title "Strengthening of banana Tissue culture lab of PARC-NSTHRI, Thatta":** Multiplied six banana varieties i.e. NIGAB-1, NIGAB-2, NIGAB-3, G-9, Dhakka and Red banana and developed 25624 shoots jars, 10277 jars of rootplants and 65967 plants shifted on hardening. Sold 50000 tissue culture banana plants @ Rs. 40/ plant with a total earning of Rs.20,00000.
- **Sugarcane bud chip technology:** A total of 81360 seedlings of five sugarcane varieties namely YT-55-Thatta (44500 seedlings), Th-2109 (24500 seedlings), Thatta-326 (1450 seedlings), HoTh-300 (9560 seedlings) and YtTh-1707 (1350 seedlings) were developed by bud chip methods at PARC-NSTHRI, Office.
- In addition, 5000 seedlings of CPF-250 and CPF-253 varieties were also developed through bud chip method at Mr. Meer Mushtaque Ahmed Talpur agricultural farm, district Hyderabad. The seedlings were transplanted in ratoon crop.
- **Seed multiplication through bud chip:** Sugarcane seed was multiplied through bud chip on 15.5 acres at different locations of Sindh.
- **Seed multiplication through conventional planting method:** Sugarcane seed was increased on 43 acres in different location of Sindh.
- **Sugarbeet variety evaluation trial:** Total seven exotic sugarbeet varieties were tested under agro-climatic conditions of Thatta. Maximum beet yield (76.00 and 68.76 t ha^{-1}) observed in SU-21006 and SU-21004 varieties and more sugar recovery (13.51 and 13.42 %,) found in SU-21006 and SU-21002.

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 GuavaSindhi Bhao, 5 Guava-Ramzan Riyali, and 24 Kronda.Prepared Neem 1204, Acacia, Acacia 1842, Conocorpus 153, Tamarind (Imli) 242, and Falsa 20 nursery plantation in the plastic shopper bags, during the reported period as a nursery in the greenhouse, shed.

- 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.
- The survival rate of the Peach for both varieties was poor, started to dry, and die within three months. Peach plants recorded high stress due to more temperatures, so the peach plantation did not survive in the existing environment of the office premises of Makli, Thatta. While, the orange, Grapefruit, and Mitho survived very well, irrigation and fertilizer were applied accordingly.
- In the Orchard-Block-I, Guava, Chico, and Falsa produced the fruits during the current season, while the fruiting process of fig was recorded as very slow, and Pomegranate and Jack Fruit did not fruit at all. During the reported period of the year 2022, the Grapes started flowering and fruiting for the first time after the plantation. The Grapes plant started fruiting on July 26, 2022, and harvested the crop on September 22, 2022, about 1000 grams.
- Total 465 concorpus, 1404 Neem, 80 Eucalyptus, 6 Gul Booti, 01 Suhanjiro, 243 Tamarind, 188 Falsa, 1842 Acacia, 150 Bougin villaea, 50 Ornamental plants, 20 Moringa, 55 Mango local, 20 Grapes, 30 Champa, 5 China Rose, 40 Golden Duranta or Box hedge plant, 40 Ficus, 30 Pomegranate, 200 Conocarpus, and 300 Eucalyptus nursery plants were transferred to the stakeholders and planted at the PAR-NSTHRI, Farm.

Capacity Building

- Imparted training to the students, different growers and mill management. They were trained for sugarcane bud chip nursery development and its management through on spot practical demonstration.
- Trained the staff of Mr. Meer Mushtaque Ahmed Talpur, deh Thaheem, near Drigh mori, district Hyderabad. They were trained for sugarcane bud chip nursery development and its management through on spot practical demonstration works out done. 5000 buds of CPF-250 variety was scooped with local bud chip machine for new seedlings developments and kept in Goni begs for sprouting.
- Imparted on spot training to the Manager and one staff of Mr. Asad Rauf Sherwani. A progressive grower of Tando Mohammad khan district at NSTHRI office regarding development of seedlings through bud chip and uses in field.
- Four scientists of Sugarcane Section, Ayoub Agriculture Research Institute, Faisalabad made exposure visit of PARC-NSTHRI, Thatta for observing natural flowering in sugarcane. They were briefed about collection of fuzz, drying and its storage. Finally, they were accompanied and collected fuzz from coastal belt of Badin district.
- Total four students of Lasbela University, Uthal, Balouchistan were trained on "Sugarcane fuzz nursery development, planting technology and quality analysis" at PARC-NSTHRI, Thatta.

PARC-National Tea & High Value Crops Research Institute Shinkiari (Mansehra)

PARC-National Tea and High Values Crops Research Institute Shinkiari, Mansehra has been mandated to conduct research and development activities for the Promotion of Tea and High Value Crops *i.e*. Fruits, Olive, Vegetables and Medicinal Plants for their Commercial Production in their potential climatic zones of the area. Development of production and processing technologies of high value crops, provision of quality planting materials to growers, capacity building of the growers in the profitable cultivation of tea and high value crops and strengthening the coordination with line the departments for collaborative approaches to address the issues of local agriculture were mainly focused during the reported period. The main progress of PARC-NTHRI Shinkiari made during 2022-23 is summarized as follow:

Research Achievements

The following research trials were conducted under different disciplines of PARCNTHRI, Shinkiari and their brief findings are given below:

Estimation of Mineral content and antioxidant activity of processed Green tea

Camellia sinensis L. leaves composed of different concentration of minerals. Minerals play a vital role in human nutrition and health. In this study, investigate concentration of mineral content and anti-oxidant in Green tea processed in NTHRI, Shinkiari. Atomic absorption spectrophotometer, flame photometer were used for Determination of mineral content. High level of calcium 52.42 mg/L, Sodium 21.60 mg/L potassium 14.55 mg/L and Magnesium 11.57 mg/L and low level of cadmium 0.046 mg/L chromium 0.0121 mg/L Copper 0.112 mg/L and Cobalt 0.083 mg/L were seen. The current study is about the antioxidant action of Methanolic extract of processed Green tea. The inhibition was measure in different concentrationssuch as 1000 µg/ml, 500 µg/ml, 250µg/ml and 100µg/ml. At 100µg/ml shows highest anti-oxidant activity. The result revealed that antioxidant potential of processed green tea was due to the significanttherapeutic importance and the presence of bioactive compounds. The color of DPPH was decolorized at all concentrations, decolor - ization indicates that research plant exhibited antioxidant potential.

Effect of media sanitation in the propagation of kiwifruit

Effect of media sanitation i.e application of fungicides, solarisation and hot water treatment was studied on the growth of kiwifruit seedlings transplanted in polythene tubes. It was found that highest seedlings survival (97.10%) was recorded in plants applied withThiofenate fungicide and was followed by seedlings in soil treated by solarization technique. Seedlings raised in Thiofenate fungicide treated soil also produced maximum growth (58.67 cm) and stem diameter (4.10 mm).

Determination Of Fruit Flies (Diptera tephritidae) Infestation In Peach Orchards In District Mansehra:

The experiment was conducted to determine the level of infestation of fruit flies in peach fruit orchards in Distt Mansehra, Khyber Pakhtunkhwa (KP) during 2022-23. Different peach fruit orchards were selected for infestation of fruit fly population in the target area. The Data regarding infestation caused by fruit flies were recorded at fortnight intervals. Data were recorded on counting healthy and infested fruits randomly from each experimental units at Distt Mansehra. The trials were laid out in randomized complete block design replicated three times. The infestations increased from mid-April and gained its peaks in August and thereafter started declined and infestation dropped to the least in month of October, April and May. It was concluded that the presence of fruit fly was recorded in all the orchards throughout their crop seasons and this window is considered a critical one in the management of fruit fly.

Field evaluation on insecticides against green peach aphid Myzus persicae (Sulzer) at District Mansehra:

The green peach aphid damage plants by sucking the sap resulting in water stress wilting and retarding growth of plant leaves especially the growths of seedlings. Their feeding on young leaves causes distortion and transmission of viral diseases. Despite many options available for their control, many producers usually use insecticides for their effective management. Present study focuses to investigate the available insecticides to check their efficacy against this important aphid. Six insecticides i.e., Acetamiprid, Diafenthiuron, Imidacloprid, Thiacloprid, Bifenthrin and Plenum tested against green peach aphids under field conditions on peach trees in Dist. Mansehra. Randomized Complete Block Design for statistical analysis. Two frequent applications were used to analyze aphid mortality. Data were taken from the leaves, three replication branches for each insecticide treatment and total of thirty branches after 24hrs and up to ten days. From the present research it is concluded, that Mospilon (Acetamiprid) was found to be the most effective insecticide as highest mortality has been observed against green peach aphid.

Effect of different planting times on the growth and seed production of Onion under the climatic conditions of District Mansehra

The yield and quality of onion seeds is highly affected by environmental conditions during growth and development. Therefore, field experiment was conducted in district Mansehra during the year 2022-23 cropping season to assess the influence of bulb planting time (1st September, 15th September, 30th September, 15th October, 30th October, 15thNovember , 30th November, 15th December and 30th December) on growth, yield and seed quality of onion. The experiment was laid out in a randomized complete block design with three replications. The combined analysis revealed that planting time of onion bulb influenced all the parameters

scored significantly earliness of both days to bolting and flowering, where the maximum values was observed in planting time of 30th September (69.92 and 84.89, respectively). On the other hand, their minimum days were obtained from late planting time of 30th December (56.67, 65.67 and 128.00 respectively). In line with this, across the different planting time highest values of plant height, stalk height, flower stalk per plant, stalk diameter, umbel diameter, yield, seed yield per plant and thousand seed weight (83.35 cm, 76.90 cm, 7.73, 7.05 mm, 58.55 mm, 2772 kg/ha, 13.59 g/plant and 3.4 gram respectively) was observed in planting time of September 30. However, their least values (67.93 cm, 67.93 cm, 6.75, 5.83 mm, 48.40 mm, 1465 kg/ha, 6.05 g/plant and 2.27 gram respectively) was attained in the planting time of December 30. As recommendation, early planting time of September 30 was appropriate planting time to produce high and quality seed yield of onion in District Mansehra.

Interactive Effect of different concentrations and timing of cuttings dipping in Indole butyric acid (IBA) on root initiation and growth of Olive

In Pakistan, there is a growing interest for the commercialization of olives after its successful cultivation in all provinces especially in Pothohar region of Punjab, Khyber Pakhtunkhwa, and Baluchistan province. In recent times, above 40,000 acres of olive plantation has been done in Pakistan. In order to ensure the sustainability of olive orchard development in Pakistan, a research trial was conducted to observe the rooting ability of olive cuttings in Mansehra region. A practical problem is that a limited rooting potential in olive cutting was observed in nurseries. Therefore this research trial was designed to evaluate the stimulatory effect of IBA with different concentrations (2000 ppm, 2500 ppm, 3000 ppm, 3500 ppm, 4000 ppm, 4500 ppm, 5000 ppm, 5500 ppm and 6000 ppm) with different dipping time durations (10 sec., 20 sec., 30 sec. and 40 sec.). The data recorded showed that maximum rooting percentages (39.50 %), numbers of roots per cutting (4.91), root length (7.14 cm), shoot length (35.70 cm) was observed in the cuttings which were treated with IBA @ 3500 ppm while minimum values for rooting percentage (20.77%), numbers of roots per cutting (3.89), root length (4.73 cm) and shoot length (23.65 cm) was found in untreated cuttings. In case of dipping time, maximum values for rooting percentage (38.62%), number of roots per cutting (5.03), root length (7.19 cm) and shoot length (35.95 cm) was observed when cuttings were dipped in IBA (3500 ppm) for 40 seconds. On the other hand, minimum percentage of rooting (25.26%) and lowest number of roots per cutting (3.98) was observed in the cuttings which were dipped in IBA solution for 05 seconds while in case of root length and shoot length, minimum values i.e. 5.34 cm and 26.74 cm were studied when the roots were dipped in IBA for 10 seconds. It is therefore recommended that Olive cutting should be dipped in the solution of Indole Butyric Acid for the period of 40 second with a concentration of 3500 ppm for better nursery production of olive cuttings.

Effect of Trichoderma Applied with Different Sulfur Levels on Yield and Sulfur Uptake By Onion (Allium Cepa L.)

A field experiment on "Effect of trichoderma applied with different sulfur levels on yield and sulfur uptake by onion (Allium cepa L.)" was conducted during the year 2022. The experiment was laid out in RCBD split plot in which four levels of trichoderma i.e (0, 1.5, 3 and 6 kg ha^{-1}) were placed in main plots while five different levels of sulfur i.e. (0, 25, 50, 75 and 100 kg ha^{-1}) were applied to subplots.The results showed that application of both trichoderma and sulfur significantly increased onion plant height, leaf area, bulb weight, fresh yield and as well as sulfur contents in onion bulbs and phosphorous concentration in onion leaves. When the data were averaged over trichoderma levels, these parameters showed linear increases with sulfur levels up to 50 kg S ha^{-1} and then remained unchanged or showed declining trend with further increase in S levels. The mean onion fresh bulb yield increased from 14.11 t ha^{-1} o 18.91 t ha^{-1} with 50 kg S ha^{-1}. Similarly, application of 3 kg ha^{-1} trichoderma seemed to be optimum level as further increases in trichoderma did not show further increases in yield or growth parameters of onion. However, the sulfur and Phosphorus contents in soil were more in treatments receiving higher levels of Sulfur and trichoderma but the total uptake was of S and P were higher in treatments receiving 50 kg S ha^{-1} along with 3 kg trichoderma ha^{-1}. These results suggested that application of trichoderma at the rate 3 kg ha^{-1} and sulfur at the rate 50 kg ha^{-1} seemed to be more effective in growth and yield contributing attributes of onion and hence recommended for higher production of onion under the agro-climatic condition of Mansehra, Khyber Pakhtunkhwa.

Assessment of Phytochemicals, Moisture Content, Polyphenols and Amino Acids in Kiwifruit (Actinidia deliciosa) Leaves.

The leaves of Actinidia deliciosa (fuzzy kiwi) were plucked from the Kiwi Garden at NTHRI, Shinkiari. The leaves were dried both under the shadow and direct sunlight. Then these were crushed to powder form for further analysis in labs. A series of experiments were carried out in labs for the identification of various phytochemicals present in the chloroform, ethanol, and distilled water extracts. Tannin was present in all the three extracts of water, ethanol, and chloroform. Saponins was only absent in the chloroform extract of shadow dried kiwi leaves while present in other extracts. Alkaloid was only absent in chloroform extract of shadow dried leaves while present in other extracts. Flavonoid was only present in distilled water extract of both the shadow and sun-dried leaves while absent in ethanol and chloroform extract. Phlobatannins were absent in all the three extracts of distilled water, chloroform, and ethanol. Phenol was present in the extracts of distilled water, chloroform, and ethanol. Steroids were found in the shadow dried extracts of distilled water, chloroform and ethanol while absent in the

sun-dried extracts of chloroform, ethanol, and distilled water. Terpenoid was found in extracts of ethanol and distilled water except for the chloroform extract of sun-dried kiwi leaves. Carotenoid was found absent in the chloroform extract of sun-dried leaves while found present in other extracts. Glycosides were found present in all the extracts. Furthermore, the moisture content in sun dried leaves was 46.03% and shadow dried leaves were 52.53%. The percentage content of polyphenol in shadow dried leaves were 0.613% and sun-dried leaves were 0.590%. The percentage content of amino acid in shadow dried leaves were 0.669% and sun-dried leaves were 0.68875%.

Performance of Different Varieties of Lettuce(lactuca sativa L.) Under Agro Climatic conditions of Mansehra

The present study was conducted to assess the performance of different varieties of lettuce under agro climatic conditions of Mansehra.Four lettuce genotypes were evaluated in randomized complete block design using 3 replications at PARC- NTHRI Shinkiari, Mansehra, during the lettuce-growing season 2022. Data were recorded, maximum leaf Length (21.6 cm), Leaf width (13.73cm), plant height (29 cm), number of leaves per plant (26), plant spreading (82.96 cm), and plant biomass with roots (286.66g), plant biomass without roots (163.00 g), maximum plant biomass only for roots (24.00 g) and root length (15.63 cm) were measured for variety red oak. While lettuce genotypes large speed displayed minimum plant height (15 cm) and minimum number of leaves per plant (16.00 cm), plant biomass with root (102.34 g), plant biomass without root (129g), plant spreading (51.86 cm) measured for genotype Red laurel respectively.The lettuce genotype red oak showed superior performance for plant height and yield attributes and could be recommended for commercial cultivation after multilocation trials. These genotypes could be recommended for general cultivation in the Mansehra region after further evaluation and for future breeding programs.

Evaluation of Different Cultivars of Garlic (Allium Sativum L.) for their Growth and Yield Contributing Attributes:

The present study was conducted to study evaluation of different cultivars of garlic (Allim sativum L.) for their growth and yield contributing attributes. This experiment was conducted at PARC-NTHRI Shinkiari, Mansehra, during the garlic growing season 2022 and using three garlic genotypes. The experimental material was planted in RCBS with three replications. Data were recorded on plant height, number of leaves, bulb weight, plant biomass, complete weight, bulb height, bulb diameter, bulb neck and number of cloves. Plant height of the tested genotypes ranged from 83.14 to 67.68 cm (China). Maximum and minimum value of number of leaf ranged from 8.73 to 6.43 (China). Minimum value of bulb weight was noticed for China (100.67 g), whereas maximum value bulb weight was recorded

for Pakhal joint (169.38 g). Mean data for plant biomass complete weight ranged from 261.33 to 144.00 (Pakhal joint). The mean bulb height varied from 48.49 mm to 40.44 mm. The average bulb diameter was maximum for the Pakhal joint (68.92mm) followed by China with 63.45 mm. Mean data for bulb neck ranged from 25.90 g to 15.8 mm (NARC G-1). Maximum values for number of cloves were recorded for China (8.73) followed by NARC G-1 (6.43). Garlic genotypes of Pakhal joint displayed superior performance for plant height and number of cloves and is recommended for onward garlic production in breeding program
Assessment of non-chemical and chemical techniques for soil/media disinfestation. The experiment to assess the impact of non-chemical and chemical techniques for media disinfection was carried out at PARC- Participatory field research station, Tarnab Peshawar, following randomized complete block design with three replications. Media was covered with transparent plastic sheets for 4, 6, and 8 weeks and treated with different levels of fungicide Folio gold (10 ml, 20 ml, 30 ml, and 40 ml). A separate control group was maintained for comparison. The results indicated that the most effective treatment for potting media disinfestation was achieved by solarizing the media (GS+Silt) under a transparent plastic sheet for 6 weeks, spanning from the 1st week of June to mid-July, combined with the application of 30 ml of folio gold per liter of water. This treatment significantly curtailed the fungi population including Phytophthora and Fusarium spp., to 480 colony-forming units per gram (CFU g-1) of media, compared to the control treatment with a population of 15,000 CFU g-1 of media. The solarization process involves utilizing the sun's energy to raise the temperature of the potting media, thereby eliminating pathogens and pests effectively. Furthermore, the judicious use of the fungicide folio gold complements the solarization process, offering an additional layer of protection against stubborn fungal species.

Comparative analysis of seed spacing and media cover effects on germination, growth and disease infestation in peach nursery.

The experimental study was conducted at the PARC-Participatory Field Research Station in Tarnab Peshawar to investigate the influence of different seedto-seed (2, 4, 6, and 8 cm) and row-to-row spacings (45, 60, 75, 90, and 105 cm) for identifying the appropriate planting density for healthy growth and development of peach stone nursery plants along with minimizing disease risk. It was revealed that peach stones sowed at 4 cm within rows and 90 cm between rows at depth of 2cm, covered with solarized canal silt showed good performance in terms of germination (70%), seedling height (75 cm), seedling diameter (9.30mm), seedling population per kanal (8000 No's) and disease incidence (<1%). These results have significant implications for peach growers, as they provide practical insights into optimizing seed spacing and media cover selection to achieve healthier and more productive nursery plants. By adopting the recommended seed-to-seed and row-to-row spacing,

growers can create an environment that fosters plant growth and lower disease incidence.

- Supervised 15 students of different Universities for their research work at NTHRI
- Published 10 research articles in various reputable Journals

Developmental achievements

- Managed the tea gardens, Plucked 27437 kg fresh green and produced 5487 kg of black and green tea.
- Managed the Fruit Germplasm Unit (GPU) at NTHRI for provision of bud/graft wood for further propagation of the selected cultivars.
- Established Mother block of 08 Kiwifruit varieties and adoptability trials of kiwifruit at Swat, Shangla, North and South Waziristan.
- Produced 2000 Kiwifruit plants of different varieties through grafting and cutting.
- Provided 2500 plants of various fruits species to the growers.
- Collected 35 varieties of fruits from reputable sources for evaluation and selection.
- Constructed green / lath house under ALP project for the production of diseased free and true to type kiwifruit plants.
- Established 02 orchards of different olive culivars for adoptability and evaluations in Hazara Division
- Propagated 10,142 indigenous olive plants
- 72,421 olive cuttings of 13 different varieties were planted in the nursery beds under high shade tunnels
- Received 644 Kg of fresh olive fruit of farmers from different locations of Hazara division & processed to obtain 65 liters of extra virgin olive oil
- 10 Kg olive leaves were processed to make olive tea
- Grafted 10,100 wild olive plants on farmers' fields
- Produced 1100 of jam of different flavors i.e. apple, apricot, peach, plum and pear.
- 50 KW solar system was installed to run green tea processing unit
- 02 no. De-Enzymers were purchased to enhance the quantity of green tea processing

Transfer of Technology

- Provided technical guidance to the growers in the cultivation of tea and high value crops.

- Coordinated with line departments for development, testing and exchange of germplasm and technologies of tea and high value crops production and processing
- Published Boucher on "Nursery raising technologies for the production of disease free and quality plants of various fruit species".

The following training events were conducted for the capacity building of the growers :

S. No.	Date	Title	Venue
1.	17th Nov, 2022	"Olive Orchard Establishment, its Management and Post-Harvest Handling of Fruit for Oil Extraction"	NTHRI Shinkiari, Mansehra
2.	19th Jan, 2023	"Top working of wild olives and different pruning techniques"	Tehsil Lora Dist. Abbottabad
3	19th Jan,2023	Awareness workshop on prospects of Olive and high value crops cultivation in Tehsil Lora, Abbottabad	Lora, Abbottabad
4.	22nd May, 2023	"Practical Training on Wild Olive Grafting on Different Wild Species & Selection of Scion Varieties"	Agriculture Extension Office Battagaram
5.	30th& 31st May, 2023	Two days training workshop on "Processing of Jam, Jelly, Squashes,	NTHRI, Shinkiari
		Ketchup and Candiees	
6.	1st June, 2023	National Tea Day	NTHRI, Shinkiari
7.	08th June, 2023	"Milling Operation, Maintenance, HACCP, Storage, and Bottling for premium Olive Oil Quality & Grafting of Wild Olives"	Village Mirpur District Haripur.
8.	26th June, 2023	"Nursery Raising and Orchard Management of Kiwifruit "	NTHRI, Shinkiari
9.	27th June, 2023	"Production of disease free nursery plants of various fruit species"	PARC-PFRS Peshawar

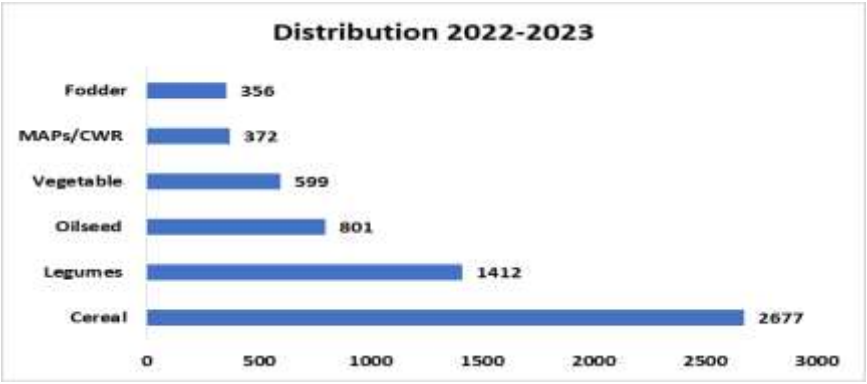
 *Tea garden NTH RI*	 *Processing of Tea*
 *Production of Indigeno us olive nursery plants*	 *Extracton of olive oi l at PARC-NTHRI*
 *duction of true to vifruit nursery plan*	 *ifruit bearing at PAR NTHRI -*
 *Awarding training to the growers*	 *Capacity building of female gender in the processing of fruit products at household level*

	
Citrus nursery at PARC-PFRS Peshawar	***Stone fruits nursery at PARCPFRS Peshawar***

Plant Genetic Resources Program

The National Genebank of Pakistan at PGRI, NARC, Islamabad being only national facility has the mandate to cater the need of breeders actively engaged in crop improvement. Plant Genetic Resources (PGR) management and conservation is the core activity of the Institute. The final germplasm inventory in the genebank reached to 43000 accessions available for sharing and utilizing by the researchers working under NARS.

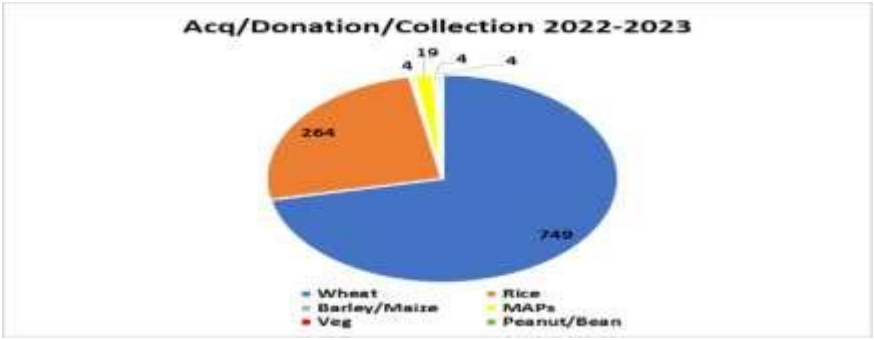
Germplasm Distribution: This year the National Genebank of Pakistan received seed requests from different institutions/universities. Only the seed requests fulfilling SOPs, were provided 6217 accession's samples of diverse crops to breeders, researchers and universities across the country.



The major crop groups requested were cereals followed by legumes & oilseed indicating research interest on major crops.

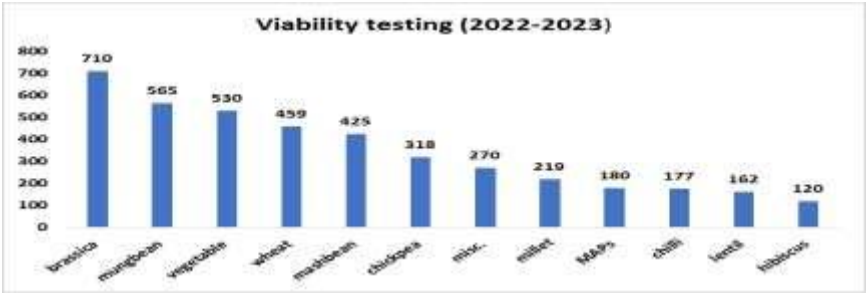
Acquisition/Donation and Collection:

About 1040 samples of various crops including wheat, barley, maize and rice etc were added to Genebank collection through acquisition/ collection and donation.



Seed Germination and Viability Testing:

Viability of the conserved germplasm accession is conducted regular at specific intervals to get updated information on viability status. This provide the basis to take appropriate measure. This year **4135** accessions were tested for viability tested for PATCO.



Evaluation and Characterization of Germplasm:

The germplasm accessions of various crops preserved in the National Genebank of Pakistan including brassica, rice, wheat, maize, Soybean, lentils, Quinoa, mungbean, cowpea, mashbean, brinjal, chilli, garlic, onion and tomato were regenerated and characterized for traits of interest.

Biochemical & Molecular Evaluation of PGRs:

Biochemical evaluation using SDS-PAGE of total seed storage proteins and molecular analysis using SSR markers was carried out for genetic diversity assessment and discrimination of rice, wheat, maize, lentils, and cowpea germplasm.

***In-vitro* propagation of Germplasm:**

In vitro conservation of sugarcane, potato, sweet potato and orchid was carried out during reporting period by using different concentrations of growth hormones in MS culture media.

Medicinal Aromatic Plants and Herbs Program Management and adaptibility of herbs:

Local and exotic plants that are being maintained in the clonal repository such as *Thymus vulgaris,Apium graveolus*, *Plectranthus* sp., *Aloe vera*, Stevia, *Coriandrum* sp., *Origanum vulgare*, *Artemisia annua*, *A. absenthium*, *Mentha arvensis* (China), Cool mint, *Mentha piperata* (Japan), Lavender (Syria) and *Ammaranthus* sp were multiplied and distributed to various stakeholders.

Processing of PARC herbal tea:

Different kinds of medicinal plants are being grown and maintained in the clonal repository at PGRI. Initially, basil, mint and thyme were selected on basis of chemical analysis, aroma, color and quality during harvesting, drying and processing. Different combinations of herbs were evaluated and handed over to PATCO for herbal tea processing.

National Herbarium Program

Native medicinal/aromatic, edible and ornamental plants and herbarium specimens were collected from Barkot, Darkot and Kot Jandaan in Margalla hills, Swat, Chitral; Utmankhel Tehsil of Bajaur district; Upper Dir, Lower Dir and Chitral. Herbarium specimens of native flora collected from different areas were accessioned to the national collection, in total over 582 specimens were accessioned. Plants collected from different ecologies are being maintained in the Botanical Conservatory, over 250 native plants are being maintained and a similar number of exotic plants are also being maintained. Herbarium specimens and a plant of *Prunus* cf. *serrulatus* were collected from Margalla hills, which represents a new record for flora of Pakistan. A new species of *Astragalus* from Qamardin Karez (Zhob district) has been described. *Allium sulaimanicum* from Takht-eSulaiman was described in collaboration with Nazar Khan, Dr. Nikolai Friesen and Dr. Reinhard Fritsch. *Chesneya balitistanica* has been described from Skardu and *Oxytropis mandokhailii* has been described from Zhob district. *Astragalus hololeios, Cicer chorassanicum, Amaranthus polygonoides, Lythrum hyssopifolium, Lepidium bonariense* and *Lepidium campestre* have been recorded as new to Pakistan. Continued to provide plant identification services to visitors, scientists, masterate and doctoral students from different institutions for completion of their research work.

Human Resource Development:

Ph.D students (3) and M. Phil (2), research internees (35) from various universities and academic institutions are being trained in agro-morphological characterization/evaluation of crop germplasm under field conditions and laboratory work regarding biochemical/ molecular analysis, in-vitro conservation, seed viability testing, seed processing, gene-bank management of PGRs and identification of herbarium specimen.

Awareness and Information Dissemination:

Total of 1265 visitors including high-level national and international delegates/dignitaries, researchers and university students paid visit to National Genebank and allied facilities. Visitors were briefed about PGR and genebank management as well as other activities of PGRI. Three seminars/ workshops were organized for awareness about importance and utilization of plant genetic resources in crop improvement programs. Ten research articles in national and international journals were published.

Genebank review by Global Crop Diversity Trust

A delegation of experts from Global Crop Diversity Trust, Bonn, Germany visited PGRI and conducted extensive review of Genebank and allied facilities. On the basis of review, Crop Trust made recommendations for upgradation of germplasm conservation facilities in the National Genebank of Pakistan.

Foreign Delegations

Visit of Students from different Universities

Southern-zone Agricultural Research Centre (SARC), Karachi Food Quality & Safety Research Institute (FQSRI)

Value addition of fruits and vegetables

Syrups and powders of date palm, jujube fruit, strawberries, *Prunus domestica* and citrus peel were developed.

Dehydration of strawberry and jujube fruit.

Research and development of value-added products of oyster mushroom.

Oyster pickle, Oyster marmalade and Oyster cookies were prepared by adding traditional recipes.

Drying process

cookies

marmalade

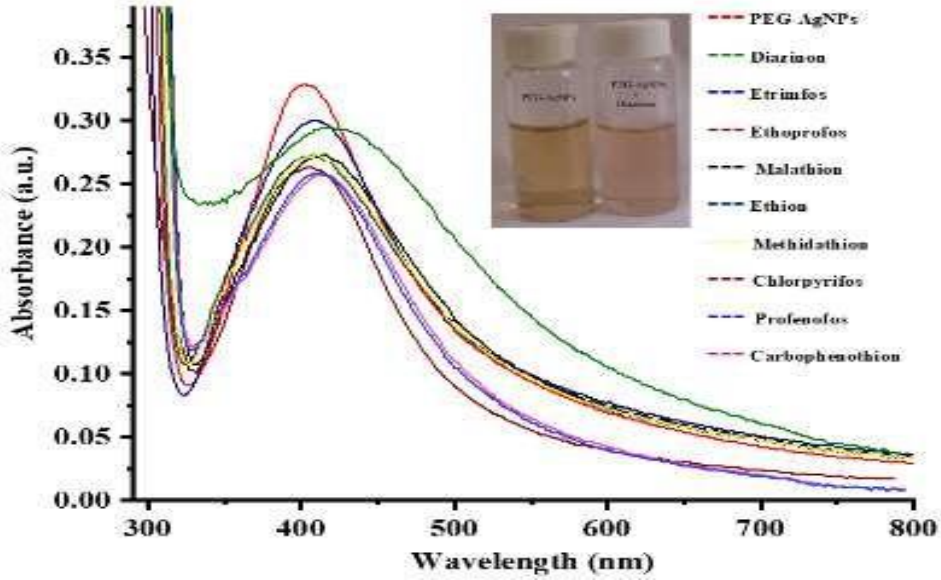
pickles

In Vitro Antifungal Potency of *Cannabis indica* (Hemp plant) against five Phytopathogens.

The aqueous extract of *C. indica* @ 15%, maximum antifungal potential was observed against *A. solani*, *C. lunata*, (100%) followed by *A. tenuissima* (86%).

Colorimetric nanosensor detection of Diazinon in water through silver nanoparticles.

Synthesized nanosensor was able to detect and quantify diazinon in a linear range of (5-90 µM) 0.001–0.03 gL^{-1} with a lower limit of detection of 0.009 gL^{-1}.



Uv spectra of silver nanoparticle with diazenon and different other pesticide.

Development and assessment of Strychnos Nux-vomica (Kuchla) as a potential alkaloidal bio-pesticide.

Alkaloids Extraction was done through soxhlet assembly with trichloromethane ($CHCl_3$)followed by trials against adult fruit-fly and mealy bug. Mortality rates recorded were 80-100% and 30- 50% respectively.

Synthesis of potential alkaloidal bio-pesticide.

<u>Development of Starch based silver nano composite films</u>.

Starch based silver nano composite films were developed, characterized and evaluated for their functional properties.

<u>Crop Disease Research Institute (CDRI)</u>

Screening/evaluation of national wheat germplasm against wheat rusts Salient outputs:

The summarized results of Wheat Nurseries 2022-2023 against leaf rust and stem rust are given below.

Leaf Rust

- Under National Wheat Diseases Screening Nursery (NWDSN) comprising 835 lines/ Entries of advance wheat breeders Material. The data revealed that 209 lines (25.2%) showed Resistance (R), 532 lines (63.71%) were Moderately Susceptible to Susceptible (MSS) and 94 lines (11.25%) were Susceptible (S).
- Under National Uniform Wheat Yield Trial (NUWYT) comprising 80 promising candidate lines. Out of these 80 lines the data revealed that 62 lines (77.5%) were Moderately Susceptible to Susceptible (MSS), 9 lines (11.25%) were Resistant (R) and 9 lines (11.25%) were Susceptible (S).

Stem Rust

- Under NWDSN the data revealed that out of 835 lines/entries 3 lines (0.35%) were showed Resistant (R), 2 lines (0.23%) were Resistant to Moderately Resistant (RMR), 34 lines (4.07%) Moderately Resistant (MR), 275 lines 32.93%) were Moderately Resistant to Moderately Susceptible (M), 43lines (5.14%) were Moderately Susceptible (MS), 388 lines (46.46%) were Moderately Susceptible to Susceptible (MSS), 88 lines (10.53%) were Susceptible (S) and 2 lines (0.23%) were variable in reaction (V).

- Under NUWYT comprising 80 promising candidate lines the data revealed that 23 lines (28.79%) were Moderately Resistant to Moderately Susceptible (M), 38 lines (47.5%) were Moderately Susceptible to Susceptible (MSS) with high infection types, 10 lines (12.5%) were Susceptible (S) and 9 lines (11.25%) were Moderately Susceptible (MS) also with high infection types.

Wheat Rusts Surveillance activities 2022-23

- The Results of Wheat rusts surveillance activity revealed that the prevalence percentage of leaf rust was 96.55% in surveyed areas of Sindh, however, high intensity i.e 80S to 100S was recorded in lower Sindh to coastal belt in highly susceptible wheat varieties. While the prevalence of yellow rust observed (3.44%) only in traces.
- No Single postule of Stem rust were observed in visited areas.
- Forty-five (45) samples of leaf rust and 2 samples of yellow rust were collected for further virulence studies.

Wheat Rusts Surveillance Activities 2023

Pest Management Research Institute (PMRI)

Comparative efficacy of different Neem oil concentrations with Imidacloprid against okra Jassid, *Amrascabiguttula biguttula* (Ishida) under field conditions

Neem oil concentrations @ (0.5%, 1%, 1.5% and 2%) and Imidacloprid was tested against jassid in okra crop. Results of study showed that maximum reduction in jassid population (63.59%) caused by 1% Neem oil followed by Imidacloprid (62%) after 48 hours of first spray. Two percent Neem oil caused phytotoxicity.

Monitoring of different species of fruit flies by using attractant methyl eugenol at PARC-SARC, Experimental Field

During monitoring three different species of fruit flies i.e *Bactrocera zonata, Bactrocera dorsalis,* and *Bactrocera correcta* were recorded throughout the year in traps. The species *Bactrocera zonata* was found dominant among all species and its population recorded to be was 89.89% throughout the year. However, other two species *Bactrocera dorsalis* and *Bactrocera correcta* were recorded throughout the year but their population remained extremely low in comparison to *Bactrocera zonata*.

Studies on biology of papaya mealy bug under lab conditions on sprouted potatoes

Mean incubation period recorded to be was 10±1days.The female laid on an average 200± 25 eggs during its life. In fourth instar, the female started to develop ovisac on the underside of its body. The pre- and post oviposition periods recoded to be were 7-8 and 8-10 days respectively. Parthenogenesis was confirmed during study.

Study the population dynamics of different insect pests and predators in okra crops grown at SARC- Experimental field

Jassid was found to be the major pest of okra followed by red spider mites and fruit borers like spotted bollworm and blister beetles during the end of crop. Different

predators like Brumus beetle, zigzag beetle, *Stethorus punctus*, seven spotted beetle and *Chrysoperla carnea* were recorded from okra crop.

Biological Tests of Pesticides Samples under Field Conditions on request of DPP.

PMRI scientists received two candidate pesticide samples from Department of Plant Protection (DPP) to test their efficacy under field conditions. The trials for testing the efficacy of Intiam 26% FS and Royal 625 FS on potato, maize, rice, peas, lentil, beans, maize and wheat were conducted at PARC- Crop Disease Research Institute Karachi and PARC- Institute of Plant Introduction , Malir Landhi Karachi. Work is in progress.

Pesticide samples efficacy trials at IPI, Karachi

Fumigation inspection services to Food Department Government of Sindh by PMRI along with team of PARC-SARC

Fumigation inspection services were provided to Food Department, Government of Sindh in all wheat storage facilities of Sindh i.e., Karachi, Hyderabad, Mirpur khas, Mithi, Shaheed Benazir Abad, Sukkur and Larkana at various locations as per schedule given by the food department.

Preparation for fumigation at Wheat Godowns Landhi, Karachi

<u>Vertebrate Pest Control Institute (VPCI)</u>

Laboratory evaluation of some indigenous plants as repellant/attractant against rodents

- ***Euphorbia millii*:** The extract of the plant caused dullness, diarrhea and restlessness. Maximum 20% mortality was noted at 10.0% concentration in 4 days.
- ***Cinnamomum zeylahicum*:** cinnamon powder mixed bait was preferred by the rats. Maximum intake (4.25 ± 1.68 gm/rat/day) was noted at 5.00% dose.
- ***Jatropha integerrima*:** Jatropha added bait was less consumed (1.50 ± 1.85 gm at 10.00%; 2.34 ± 1.95 gm at 5.00% and 4.86 ± 2.28 gm at 2.50% doses) in comparison to control (6.75 ± 2.30 gm) per rat per day. Moreover, two rats were died on 4th and 5th days after the consumption of Jatropha bait at 10.00% dose.
- ***Lilium*:** The rats on higher doses were found sick and sluggish whereas on 10.00% twenty percent mortality was observed.
- ***Lantana camara*:** The plant added bait consumption was 2.63±1.30 gm at 5.00%; 1.95±1.79 gm at 10.00%; 1.42±1.20 gm at 20.00% concentrations. Where as in control (plain bait) the consumption was 3.58 ± 1.19 gm.

Rearing and culturing of rearing of field rats (*Rattus rattus*)" in animal house of VPCI"

- Rats were collected from field and reared under the laboratory conditions at VPCI, SARC PARC.
- PARC-Rat bait was prepared and sold to interested customers.

Grain baits for rats & mice

Pellets for rats & mice

Capsular bait for wild boar

Institute of Plant Introduction

The main activity 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.

- **Introduction of new Olive varieties:** (Arbosana, Arboquina, Hojibalanca, Picual, Jurboi, Manzanilla, Bari-1, Chemleli) were introduced and propagated in nursery. Olive plants were delivered to the progressive farmers of olive potential areas in Khirthar range Dadu Nawabshah, Thatta, Badin, and Gadap Karachi under PSDP project titled "**Promotion of Olive cultivation on commercial scale in Pakistan Phase II**.

- Dragon (*Selenicereus undatus*) fruit plant was planted for evaluation and introduction in coastal area. 28 Nos Dragon fruit (Red undatus) were planted in field at IPI under drip irrigation using marginal quality irrigation water having EC 3.2 $dS.m^{-1}$. Initial fruit was harvested of Dragon fruit in three plants.
- Healthy and matured nuts of Srilankan green tall coconut variety has been maintained for further propagation.

Olive flowering stage

Olive plants in nursery

Srilankan Coconut

Dragon Fruit Plant

National Sugar and Tropical Horticulture Research Institute (NSTHRI), Thatta

Quality Seed Production of Sugarcane

The sole motive behind the conduct of different sugarcane variety evaluation and development activities at the institute is to produce quality seed of newly developed sugarcane varieties which ultimately can contribute in enhancing cane yield of the growers and sugar recovery of sugar mills. The detail of sugarcane variety development activities for quality seed production of newly developed sugarcane varieties is as under:

Evaluation and Selection of Sugarcane Clones/Genotypes:

In different varieties evaluation trials of the cropping year 2021-22, a total of 2658, 230, 187, 14, 12, 6 and 3 sugarcane clones/genotypes were maintained in single plant trial, 1st cycle, 2nd cycle, 3rd cycle, 4th cycle, preliminary yield trial, and advanced varietal trial, respectively, out of which 695, 71, 35, 7, 6, 4 sugarcane clones/genotypes were promoted to 1st cycle, 2nd cycle, 3rd cycle, 4th cycle, preliminary yield trial, and advanced varietal trial, respectively and are being maintained in 2022-23 crop for further evaluation at Makli farm, Thatta.

Sugarcane Genotype Selected for NUVYT Study:

The promising sugarcane line Thatta-1909 has been selected for further study in NUVYT (2023-2025 cropping seasons). Furthermore, the seed of the promising sugarcane lines of the institute viz Th-1970 and Th-1822 has been sent for further multiplication and evaluation in NUVYTs (2022-23 cropping season) at 9 different sugarcane research institutes of public and private sector in Pakistan.

Sugarcane germplasm:

In sugarcane germplasm 2021-22 crop a total of 262 varieties/lines were planted for flowering study and fuzz collection, at Makli experimental farm, Thatta. Out of total, 71 booted, 67 had completely flowered and 3356 gram true fuzz was collected from the same sugarcane varieties. In germplasm 2022-23 crop a total of 311 and 46 sugarcane lines are being maintained at Makli farm and Mr. Mohammad Sharif Bhurgri farm, Badin district, respectively.

Crossing block trial:

In 2021-22 a total 13 matching flowering behavior parental lines of sugarcane were maintained at Makli farm for the purpose of quality fuzz production under field conditions. At the time of flowering initiation, the flowers of the different parental sugarcane lines were covered with crossing bags till seed setting period and collected 164 g of sugarcane fuzz. In 2022-23 a total of 27 sugarcane varieties in crossing block at Mr. Mohammad Sharif Bhurgri farm are in good growth condition.

Collection, Drying and Storage of Sugarcane Fuzz:

Total 13 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:

Fuzz nursery was maintained and developed 10500 sugarcane seedlings from locally collected Polly-Fuzz and bi-parent crosses up to December 2022. Additional 7,200 seedlings have been developed up to June 2023.

Sugarcane Bud Chip Technology:

A total of 81360 seedlings of five sugarcane varieties were developed by bud chip methods at PARC-NSTHRI, Office. In addition, 5000 seedlings of CPF250 and CPF-253 varieties were also developed through bud chip method at Mr. Meer Mushtaque Ahmed Talpur agricultural farm, district Hyderabad. And transplanted in ratoon crop. Sugarcane seed was multiplied through bud chip on 15.5 acres at different locations of Sindh. Sugarcane seed was increased on 43 acres in different location of Sindh during 2022.

Sugarcane seedlings at NSTHRI,Thatta

Quality Seed Production of Banana through Tissue Culture

Under Winrock PAD International project title "Strengthening of banana Tissue culture lab of PARC-NSTHRI, Thatta" following activities under tissue culture laboratory were carried out from July 2022 to June 2023.

During the reporting period, developed disease free seed of six banana varieties i.e. NIGAB-1, NIGAB-2, NIGAB-3, G-9, Dhakka and Red banana. During multiplication, developed 18846 shoots jars, 5231 jars of root-plants and 33648 plants shifted on hardening. Sold 29,000 tissue culture banana plants @ Rs. 40/ plant with a total earning of Rs.11,60,000/- However, actual price of TC banana plants in PARC is Rs. 100/plant.

Disease free banana seedlings developed through tissue culture

Production of disease free banana plants in tissue culture laboratory

Projects Executed and Developed by PARC-SARC Scientists

- **Executed**2 in number
- **Projects approved**
  2 in number
- Projects developed for ALP 9th and 10th Bath- 26 in number

Research Co-ordination with national and international partners

- Under Winrock PAD International project title "Strengthening of banana Tissue culture lab of PARC-NSTHRI, Thatta" Multiplied six banana varieties i.e. NIGAB-1, NIGAB-2, NIGAB-3, G-9, Dhakka and Red banana and developed 18846 shoots jars, 5231 jars of root-plants and 33648 plants shifted on hardening. Sold 29,000 tissue culture banana plants @ Rs. 40/ plant with a total earning of Rs.11,60,000/-
- "Regulatory Harmonization in Pakistan for MRLs and Bio-pesticides" funded by CABI/USAID/USDA (ongoing project).
- Department of Plant Protection for "Biological Tests of Pesticides Samples under Field Conditions".
- Food Department Government of Sindh for inspection of fumigation in wheat godowns in Sindh.

Research Publications by PARC-SARC- Scientists

- 29 in number

Trainings (Internships, Ph.D, M.phil)

- Internships: 39 in number
- Ph.Ds and P.phil: One Ph.D and three M.phil

Technology Transfer Activities

- Trainings on "Bud chip technology" were imparted to different growers, students and individuals of sugar mills in Sindh.
- A Hands-on training was organized on "estimation of Aflatoxin (total) through ELISA technique" to Quality Assurance & Quality Control team of MATCO Rice Company at FQSRI, PARC-SARC Karachi on 07 Dec 2022.
- A three-day practical training session was conducted at the Foodborne Pathogen and Microbial Contamination lab from 19 to 21 January 2023. 25 participants from academia and industry, covered essential topics i.e. tissue culture technique, spawn production, and oyster growing techniques.
- Arranged a seminar on "**Introduction, cultivation and value addition of olive in Sindh"** for Academia, Scientists, officers of Extension department Sindh, officers of Sindh Forest department, Progressive growers, NGOs, Private organizations on 29th May, 2023 at IBA, Sukkur.
- Arranged a seminar on "**Awareness on the Production Technology of Olive in Sindh**" for all the stake holders Academia, Scientists, officers of Extension

department Sindh, officers of Sindh Forest department Progressive growers, NGOs, Private organizations on 08th December, 2022 at Thana Bola Khan, District Jamshoro.

NATURAL RESOURCE DIVISION:

Climate, Energy and Water Research Institute, NARC

Sub-ecological zonation of KPK and Punjab provinces

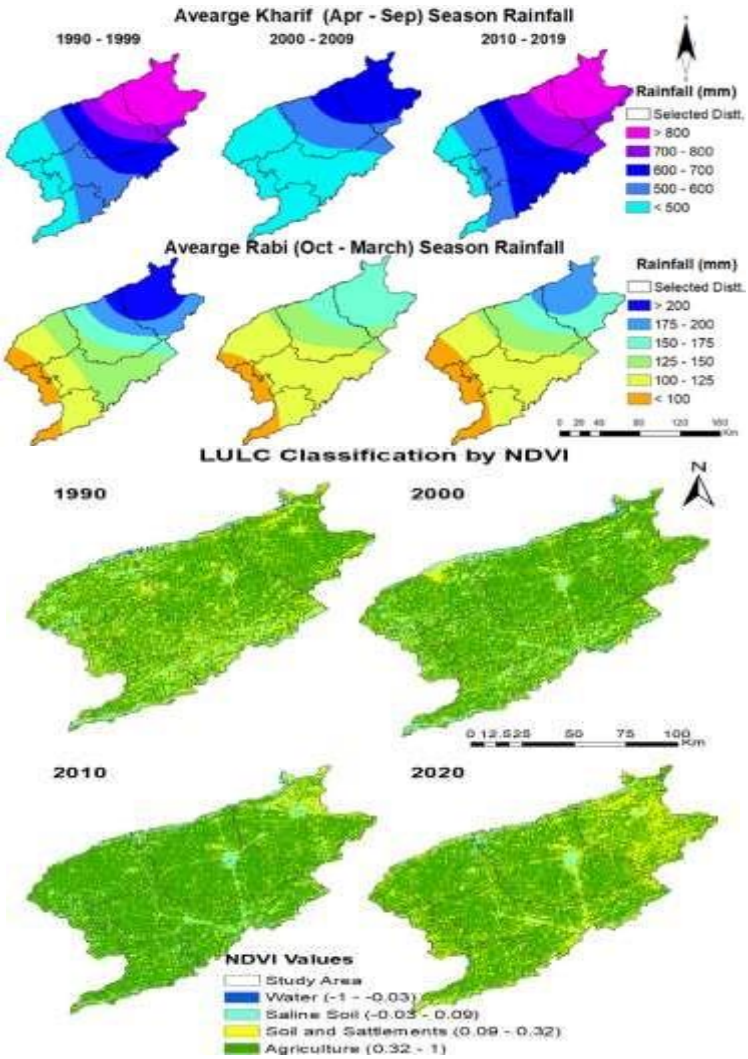
PARC identified sub-ecological zones in Khyber Pakhtunkhwa and Punjab provinces based on recent agro-climatic, landform, and land use data. In KPK, seven zones were delineated, with dominant sub-humid mountain valleys in the north and semi-arid mountain valleys in the south, where agriculture is limited and grazing is prevalent. Punjab province comprises eight zones, including irrigated plains in the central part, semi-arid plains in the north-east, and rainfed plateaus in the north-west.

Sub-ecological zones Punjab

Sub-ecological zones in KPK

Spatiotemporal rainfall variability and agricultural area loss assessment

The study revealed significant changes in Kharif and Rabi rainfall patterns over a decade, with Kharif experiencing increased rainfall while Rabi faced belowaverage precipitation, impacting wheat sowing and exacerbating salinity issues. The NDVI vegetation index indicated substantial agricultural area loss in 10 years, with salinity showing fluctuations due to wheat growth. Waterlogged expansion was observed on 7883 ha using MNDWI water index, and urbanization increased by 46554 ha, posing a serious threat to food security in productive agricultural areas.



Variation in rainfall pattern in three decades and classification of agricultural area and other features by NDVI

Evaluation of Responsive Drip Irrigation (RDI) in comparison with conventional drip and furrow irrigation for seasonal vegetables

PARC garlic was evaluated for three irrigation methods: Responsive Drip Irrigation (RDI), conventional drip irrigation, and furrow irrigation. The results highlighted that RDI and conventional drip irrigation demonstrated superior water usage efficiency, achieving remarkable water savings of 85% and 70%, respectively, compared to furrow irrigation. Additionally, the Drip Irrigation methods positively impacted yield, with a 10% increase observed for conventional drip irrigation and a 5% increase for RDI, showcasing their effectiveness in conserving water and improving crop yield.



Garlic on furrow irrigation **Garlic on drip irrigation** **Garlic on RDI**

Water usage and impacts of different irrigation methods

Irrigation Method	Water Usage (litres)	Yield Increase (%)	Water Saving (%)
Responsive Drip Irrigation	3500	5	85
Conventional Drip Irrigation	12000	10	70
Furrow Irrigation	24000	0	0

Dissemination of technologies to farmers/professionals and agricultural service providers

The institute developed a brochure on Nano Porous pipe and a soft copy is available for distribution and printing. Capacity of 88 farmers, 1035 professionals and students were improved on water management technologies through trainings, workshops, field days and field visits to demonstration sites.

	
Handing over certificates of distinction on the successful completion of two days (Dec 6 to 7, 2023) professional training workshop	**Exposure visit of professionals from AARDO countries to Satrameel field station.**

LAND RESOURCES RESEARCH INSTITUTE, NARC

- **Integrated Nutrient Management (INM) based demonstrations**

Integrated Nutrient Management (INM) based demonstrations were conducted on farmers' fields across the country. It was observed that nutrients (N:P:K:Zn:B=120:90:60:5:1 kg/ha) and biozote/humic acid at fifteen sites resulted in a decrease in soil pH and a significant 15-30% increase in crop yield compared to Farmers' Practice (FP).

- **Role of microbial decomposers on composting of some invasive weeds**

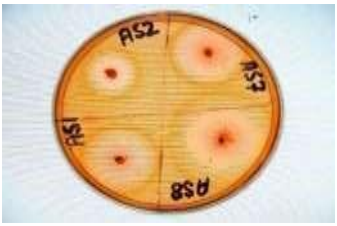
A study was conducted with objective to find the best decomposer bacterial strain for efficient compost production from green wastes. Bacterial isolate RGD 6(4) and consortia RGD 6(4), RND 6(1), RGD 6 outperformed the control in terms of pH, EC, temperature, moisture content, and total organic carbon, indicating their effectiveness for rapid decomposition and superior compost quality.

- **Farm waste management through biogas production**

NARC-inocula (B. *dimunuta, P. bauzanesis and B. paramycoids*) were prepared and tested for biogas production along with un-inoculated control in static batch reactor (1-2 L) under laboratory conditions for 40 days and compared with other inocula.

The trend of various inocula efficiency for biogas production was NARC-inoculum > Ch-inoculum > D-inoculum showing 12 folds, 11 folds and 8 folds increase in biogas production over control.

The quality of biogas in terms of methane contents was also improved by bacterial inoculum as compared to control.



Isolation of bacteria lab scale

Inoculation of bacteria at Biogas plant site of biodegrading LRRI at NARC

Rice Residue Management for Sustainable Wheat Productivity

The challenge of abundant crop residues left after combine harvesting, was addressed through interventions with Pak-Seeder and Super-Seeder. These innovative tools successfully enabled for timely wheat sowing in standing residues. Field trials demonstrated remarkable outcomes, including an 8-12% increase in wheat yield, reduced bulk density by 5%, and a 16% increase in soil aggregate stability after three years. Moreover, effective porosity increased by 4%, refilling porosity by 8%. Water conservation of 21% with Pak-Seeder and 12% with Super-Seeder was recorded as compared to conventional methods used by farmers.

Super-Seeder

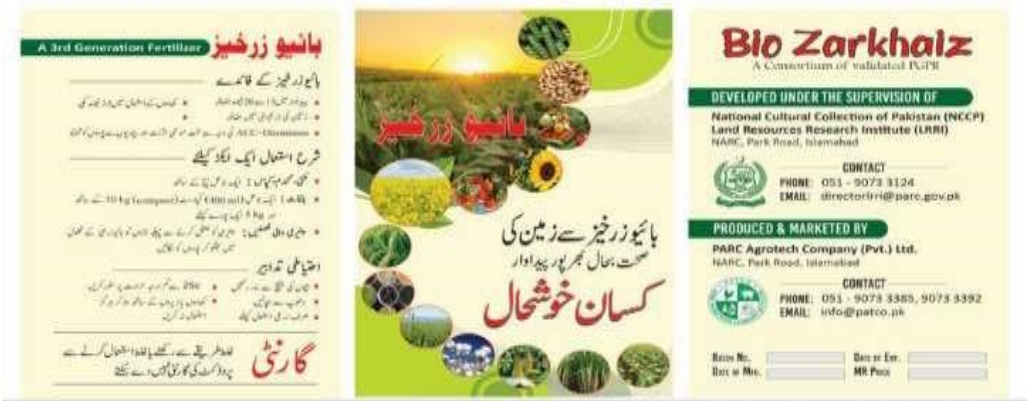
Pak-Seeder

Crop Residue Removal

Driving Agricultural Innovation from Laboratory to Field for Sustainable Crops with Bio-Zarkhaiz: A 3rd Generation Biofertilizer

Land resource research institute has introduced Bio-Zarkhaiz. This product has unparallel ability to enrich soil health. It is packed with diverse beneficial microorganisms. Various trials have reflected its ability to thrive soil microbiome thus enhancing nutrient uptake for plants. Experiments have revealed that BioZarkhaiz can increase crop productivity up to 30-35%. It has also reduced the reliance of crops to chemical fertilizers up to 30-35%.

Field trial of Bio-Zarkhaiz



Publications for knowledge dissemination

Honeybee Research Institute, NARC

Technology Validation of Apitoxin Collection from Honeybees *Apis mellifera* L. as high value product in apiculture

Bee venom proudction for therauptic purpose in pakistan is quite underexplored.A study was carried out to gather bee venom from *Apis mellifera* L. colonies using different collectors. It was assesed that how it affected bee colony

behavior. We compared a local bee venom collector with an imported one from Korea.The results revealed peak production at 0.45mg/colony achieving considerable results. Study identified that though locally designed venom collectors displayed high bee mortality but is considerably easy to use and hence is quite promising for future use.

Bee Venom Collection Procedure

Range Research Institute, NARC

- **Introduction and propagation of fast-growing hybrids MPTS in agroforestry nursery in RRI, NARC.**

Raising of nurseries provide quality planting stock and self-employment opportunities to the farmers where they can use their free time for nursery operations. Nursery in RRI produced five hundred Turbo hybrid Robinia plants, a thousand willow cultivars, two hundred Hybrid *Paulownia elongata* 9501, fifty *hybrid Tecoma grandis*, and five hundred Hybrid *Populus deltoides* were successfully propagated using advanced techniques in our agro-forestry nursery.

Hybrid *Paulownia elongata* 9501 propagation through soft/root cutting in agro-forestry nursery RRI, NARC

- **Assessment of Potential Fast Growing Hybrid Tree Species in Silvo-agricultural System in Pakistan.**

The project successfully introduced and evaluated the yield and carbon stocks of five fast-growing agro-forest tree species, with hybrid *Populus deltoides* standing out for its impressive 5.28 t/ha biomass productivity and 2.64 t/ha carbon stock. The initiative also assessed the influence of trees and intercropping on soil health and carbon stocks, while promoting awareness among local farmers and timber industries.

Study site in Pindi Gaib

Plantation view of hybrid Populus deltiodes Paulownias elongate after two months

- **Balochistan Agricultural Research & Development Center, Quetta Release of Varieties**

BARDC achieves significant progress in crop breeding. As 3 new wheat, 2 barley, and 1 lentil varieties were released. Notably, last year marked the release of 03 more varieties including Ejaz-21, JE-21, and Dasht-21, while high-yield disease-resistant durum wheat and 02 barley lines are set for release.

Naked Barley Line I

Black Barley Line II

Durum Line

- **Establishment of Olive Orchards at BARDC and on farmer fields in Balochistan.**

BARDC is working on olive since 2013 and till 2022-23 about 9300 acres were brought under olive cultivation. During the year 2022-23 about 180,000 (on 1300 acres) olive plants were distributed (33% farmer's share) in 18 districts. In total PKR 16.704 million were collected as farmer's share through BARDC component, which is the 3% of total collection by Olive PSDP project.

- **Installation of Olive Double Shaded Nursery Tunnel under PSDP Olive Project at PARC-BARDC Quetta**.

Olive double shaded nursery tunnel is operational at PARC-BARDC Quetta, a standout achievement under the Olive PSDP project. With 80000 cuttings set to thrive, this facility leads PARC-BARDC as Balochistan's premier nursery producer, fortified by its exclusive mother orchard. In coming years by using double shaded tunnel, PARC-BARDC will be able to fulfill Balochistan requirements of olive plants.

Olive Double Shaded Nursery Tunnel at PARC-BARDC Quetta.

- **Installation of Solar Tube Well at PARC-BARDC under PARC Research Fund.**

Installation of Solar Tube Well completed at BARDC farm Quetta amounting PKR 9.6 million from PARC Research Fund 2023. This solarization will irrigate 45 acres of farm, orchards, nurseries, office buildings and BARDC colony and will save huge expenditure on utility bills and will pay back in 3-4 year time.

Water extraction using Solar energy

- **Introduction and installation of High Efficiency Irrigation System in Balochistan**

Despite being the largest province, low yield is prevalent mostly due to water scarcity. BARDC aims to address this issue by introducing High Efficiency Irrigation Systems (HEIS) to conserve water for generations. The impact is quite huge as 900 acres of Drip Irrigation have been installed since 2014-15 and 555 acres have come under HEIS during this year alone, aided by farmer contributions.

- **Products Developed by BARDC**

BARDC is working on medicinal herbs since 2004. BARDC have about 52 different medicinal herbs in its medicinal herbs garden. During the year 2022-2023 BARDC produced different herbs like Rosemary (37.0 kg), Chamomile (33.0 kg), Oregano (7.5 kg), Lemon grass (7.0 kg), Thyme (6.0 kg), Tarragon (6.0 kg), Mint (7.0 kg) and Saffron Stigma (200 grams). The herbs were either sold by PATCO, Islamabad or sold by BARDC to generate income. Likewise, 6000 saffron bulbs were provided to PATCO for sale during 2022-23.

Saffron (Stigma) **Chamomile** **Sage**

Mountain Agriculture Research Centre, Gilgit

Establishment of MPTs Nursery

BARDC established nursery of 1000 cuttings of three different varieties of Poplar in order to know the comparative analysis of growth and selection of diseases resistant variety, survival rate and growth performance of Chilgoza pine nursery.

Nursery of Multipurpose trees

Testing of Vegetables Variety

At MARC Juglote, we evaluated 8 Tomato, 4 Brinjal, 4 Hot Chili, and 3 Radish varieties. It was observed that Roma Tomatoes (47.2 t/ha), Padagoda Brinjals (29.3 t/ha), China Red Chilies (7.63 t/ha) and China Red Radishes (36 t/ha), displayed impressive yields. The experiments will be continued next year for final selection. About 83 kg seed of China Cabbge and China Red Radish produced and distributed to Progressive farmers on subsidize rate promising a flourishing harvest ahead. The centre produced 70 thousand seedlings of sweet pepper, hot chili, tomato, brinjal and onion; and provided to farmers / agriculture Extension department GB

Enhancing production of fruits in Gilgit-Baltistan

Significant achievements and results emerged from the provision of 5000 deciduous fruit plants including apricot, apple, cherry, pear, plum, fig, walnut, and almond, benefiting farmers, NGOs, and government organizations. Additionally, 6000 deciduous fruit plant root stocks were grafted for apricot, apple, pear, peach, and cherry. Notably, 30,000 local olive plants were distributed to farmers, NGOs, and the Pak Army, alongside the collection of GPS data for 240 olive orchard fields.

Effective Botanical Pellets Combat Onion Maggot Infestation

The potent insecticidal activity of botanical pellets derived from four native herbs against onion maggot was explored. Through field trials, these botanical pellets were pitted against four synthetic insecticides in combating *Delia antiqua*, particularly executed at Thorgu Bala village. The results displayed potential of *A. sieversiana* pellets, which proved equally effective as chemical insecticides in curbing onion maggot infestation.

Maintenance of Demonstration plots/Potato Crop

Maintenance of Medicinal Plant demonstration plots are thriving through extreme care, where new plants are consistently replaced by withered ones. The process consists of essential tasks like weeding, irrigation, and diligent hoeing. Furthermore, for attaining self-sufficiency, the planting and nurturing of Seed Potato Crops nis being carried out since 2022-2023 cropping season, in PARCMARC Astore's Screen houses and leased fields under the "Self Sufficiency of Virus Free Potato Seed Multiplication" project.

Maintenance Activity as per routine

Arid Zone Research Institute, Bahawalpur

- **Response of different weed control methods (Chemical & Cultural) on Mungbean cultivars**

A Kharif 2022 field experiment at Arid Zone Research Institute, Bahawalpur, Pakistan, focused on cost-effective weed control methods. Among the treatments, Treatment 4, featuring Stomp 330 EC (Pendimethlin) pre-emergence weedicide and two hoeing, yielded the highest seed yield of 1734.6 kg/ha.

- **Testing of Wheat Advance/ Candidate Lines of PARC AZRI, Bahawalpur in National Uniform Yield Trial 2022-23 & Wheat Disease Screening Nursery2022-23.**

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.

- **Comparison of various techniques for cotton productivity in Saline Soil of Cholistan under ACIAR ASSIB Project of PARC, AZRI, Bahawalpur**

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.

- **Testing Evaluation and Yield Comparison of various advance lines of Ispaghol for their growth & yield performance (screened out of Ispaghol under ALP Project for varietal development under agro-climatic conditions of Bahawalpur.**

The experiments yielded 17 high-yield genotypes, excelling in traits like drought resistance, heat tolerance, and productivity, have been selected for further varietal development, depicting a significant achievement in arid Cholistan desert conditions.

- **Adaptability Trials of Olive for Growth and Yield Performance under Saline and Drought Conditions of Cholistan desert of Bahawalpur**

Sixteen olive varieties were evaluated, with Arbequina, Gemlik, and Arbosana standing out for their impressive performance in Cholistan's droughtstressed environment. These varieties demonstrated robust growth rates and successful fruiting, marking a significant advancement for olive cultivation in the region.

Olive plantation in AZRI

ARID ZONE RESEARCH CENTRE, D.I.KHAN

- **Varieties Developed at AZRC**

Wheat variety **"AZRC DAMAN"** released from Provincial Seed Council, KP during 2023.

Wheat variety "AZRC Daman" in Field at AZRC Farm

At AZRC farm, four (04) candidate lines for Wheat, Chickpea, Saonf, and Ajwain were developed. The first-year DUS data was jointly completed with FSC & RD, DIKhan.

AZRC-20 Variety in field at AZRC Farm

AZRC (AJWINE) in Field

Major Technical Achievements

Substantial quantities of basic and pre-basic seed of Wheat (22 ton), Chickpea (10 ton), Lentil (3.5 ton), and Guar (62 kg) varieties were produced. Pulses varieties were distributed to end-users in DIKhan, Tank, and Lakki Marwat. Advisory services were extended to the farming community, offering guidance on livestock and agricultural practices.

Training, Seminar and workshops at AZRC and ARDIS

Arid Zone Research Centre, Umerkot

- **Strengthening/Up-gradation of Agriculture and Livestock Research System of Arid Zone Research Institute, Umerkot-Sindh**

The Arid Zone Research Institute (AZRI) in Umerkot, Sindh, has undergone "Strengthening/Up-gradation of Agriculture and Livestock Research System," PARC has extended the project by one year to finalize pivotal elements, including

the construction of a modern guest residence, RO plants, a 15 KW solar system, camel shed, and a rainwater harvesting pond. The initiative also included the establishment of state of art laboratory, furnished with lab glassware, chemicals, and machinery, further emphasizing the institute's commitment to advancing agriculture in this promising but less developed area.

New Infrastructure of AZRC Umerkot

- **Establishment of good chili production and development of postharvest management technologies in Pakistan**

Project under KOPIA-Pakistan project carried out Chilli cultivation, including setting up effective nursery sheds to combat pests like white flies. By monitoring and aligning pre and post-harvest processes, the project ensured highquality chillies with minimal losses. The installation of two advanced Solar Energy Dehydration Plants, powered by 25KV solar energy, led to the successful drying of
16,000 kg of fresh chillies, yielding 4,480 kg of top-grade dried chillies with a 28% recovery rate.

Chili production

- **Introduction & maintenance of high efficiency irrigation system in arid areas**

A significant achievement has been made through the maintenance of 14 high-efficiency solar-powered submersible water pumps at the center. These pumps have proficiently irrigated orchards spanning 62 acres, including Ber, Chiku, Date

palm, Guava, and Lemon. The adoption of these advanced irrigation systems resulted in impressive water savings of 75-80%.

Fruit trees grown on drip irrigation

- **Capacity building of different farming communities & members of different organizations**

AZRC conducted various capacity building activities involving diverse farming communities and organizational members through comprehensive training, including Training of trainers, farmers, extension workers, and NGOs. Over 100 Local Government and Agriculture Extension Department members, 50 NGO representatives, and 500 community farmers were equipped with enhanced knowledge on climate change, CSA, and various agricultural practices.

Different trainings being conducted

- **Water and Agricultural Waste Management Institute, Tando Jam,Expansion of Tissue Culture Banana Cultivation in Sindh**

In 2021-2022, the approval and recommendation of NIGAB-1 and NIGAB2 Tissue Culture Banana varieties for commercial cultivation in Sindh Province marked a significant milestone. Additionally, the ongoing approval process for NIGAB-3 and NIGAB-4 varieties further establish the advancement of banana cultivation in the region.

- **Management of Nursery and provision of Tissue Culture Plants to Growers**

Banana Tissue Culture Plants (in rooting jars) provided by Bio-Technology Research Laboratory, NARC Islamabad were kept for shifted to nursery bags for primary and secondary hardening and provided to different progressive growers of Sindh Province for field plantation at their farms.

Nursery establishment and transfering plants to farmers

Animal Sciences Division:

- **DETAIL OF RESEARCH ACTIVITIES, ACHIEVEMENTS AND PROGRESS**

i. <u>Animal Reproduction and Genetics Program (ARGP)</u>

<table>
<tr><td colspan="3">Project1: Investigations and Optimization of Sperm Sexing and Cryopreservation Techniques in Water Buffalo (ALP-337)</td></tr>
<tr><td>The Magnetic Nanoparticle based sperm sexing technique was optimized for buffalo spermatozoa. Mean fold expression of female specific gene (X-linked proteolipid sorted protein) was 15.34-fold higher in sex of spermatozoa as compared to unsexed in spermatozoa (1.60).</td><td> 
Sperm Sexing Water Buffalo through MNPs</td><td> 
Validation sperm sexing technique by real-time PCR</td></tr>
<tr><td colspan="3">Project 2: Nanotechnology-Enabled Improvement of Spermatozoa Cryopreservation Technique for Water Buffalos (ALP-341)</td></tr>
</table>

Doses of Zinc Oxide (12.29 mmol/l), Cerium Oxide (0.29, 0.58 and 1.16 mmol/l) and Manganese Oxide (0.2, 0.4 and 0.6 mmol/l) nanoparticles (nano-antioxidants) were optimized for buffalo spermatozoa.It is expected that use of these nanoantioxidants in cryodiluent will improve the cryopreserved quality and fertility of buffalo spermatozoa.

Project 3: Improvement in the livelihood of Rural Farmers through Improving Livestock Reproduction Services at Union Council Rang Shah, Arif Wala, Pakpattan (FAO-ASI Project TFD-21/Pak/001)

The marginal livestock farmers (n=955) from 27 villages of District Pakpattan got facilities of AI services and pregnancy diagnosis. An overall conception rate of 70% was achieved with AI of Nili Ravi buffalo, Sahiwal and Holstein Friesian bulls frozen thawed spermatozoa.

AI with high genetic semen of exotic Holstein Friesian

Crossbred calf born through AI with exotic Holstein Friesian semen

Title of project: 4. Breed Improvement of non-descript Goat through Assisted Reproductive Techniques

The high genetic progeny of Beetal (n=20) and Saanen (n=11) bucks were produced through Laparoscopic Artificial Insemination by using frozen thawed spermatozoa.

Laparoscopic AI in goats

Saanen crossbred kid

Title of Project 5. Standardizing the Outc ome of In Vitr Fertilization and Embryo Transfer Technologies in Water Buffalo

In Pilot experiment,one buffalo was detected pregnant through embryo transfer (vitrified embryo) at ASI.

Embryo Transfer in buffalo

Ultrasonogram of buffalo Fetus at Day 40 of Gestation

Financial resources and budget: ALP Projects = Rs. 4.1 million

ii. **Animal Product Improvement Program (APIP)**

Project 1:Isolation, Characterization and Utilization of Riboflavin (Vitamin B2) Producing Lactic Acid Bacteria for Preparation of Neutraceutical Yogurt
• The mean riboflavin level in the currently available market milk and yogurt was found to be 2.55 ± 0.57mg/L and 2.52 ± 0.66 mg/L. • Four strains of Lactic Acid Bacteria were identified as riboflavin overproducers. The riboflavin concentration produced by these strains in the yogurt ranged between 4.71 mg/L to 6.38 mg/L (significantly higher than that of market yogurt samples), and thus were considered suitable for preparation of riboflavin enriched neutraceutical yogurt.
Financial resources and budget: ALP Project =Rs. 4.943 million

iii. Aquaculture and Fisheries Program (ARGP)

Project1: Validation and Establishment of Intensive Production Packages for High Value Fisheries	
• Developed protocol for different stocking densities and culture systems of carps and catfish under poly culture system (monoculture, bi-culture and polyculture). • Developed different feeding regimes for optimum growth (15%, 20%, 25% and 30% Crude protein). • Appropriate stocking densities and species combination with various management inputs are successfully made. American channel catfish showed highest total weight gain i.e.0.81 kg followed by silver carp i.e.0.76 kg.	 Different fish species in intensive farming system at NARC
Project 2: Introduction of a High Value Fish *Channa striatus* (Saul) in Aquaculture system of Pakistan	

- Successfully acclimatized *Channa striatus* (Saul) germplasm in semi-intensive culture system installed at experimental site.
- Protocols for Saul growth performance using different stocking densities in semi- intensive culture systems have been developed.Up to 0.30 kg total weight gain has been achieved in Saul fish.

Channa striatus acclimatization and measurement of growth performance

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

iv. National Reference Laboratory for Poultry Diseases (NRLPD)

Project1: Monitoring of Avian Influenza and Newcastle Disease in Backyard Poultry in Pakistan (PM Initiative of Backyard Poultry under L&DDB, MOU project, ASI, NARC Component).

Under the L&DD project "PM initiative for Backyard poultry" 560 backyard poultry serum samples were received at NRLPD. The samples were analyzed for Avian Influenza and Newcastle Disease through serology.The HI titer for AIV subtypes rangedbetween 0.0-9.0 for H5, 0.0 for H7, and 0.0-11.0 for H9. The titer ranged between 0.0-11.0 for NDV.

Project 2: Surveillance of Anti-Microbial Resistance (AMR) in Poultry (Fleming fund UK)

- Commercial broiler birds (n=628) sampled from Live Bird Markets (LBM) were analyzed for *E. coli*, *Salmonella* and *Enterococcus*andfor antimicrobial susceptibility.
- The most commonly resistant antibiotics were Tetracyclines,

Nalidixic Acid, Quinolones, Streptomycin, Particpation in PTS	Certificates of Particpation in PTS	Certificates of Penicillin,
Quinopristin/Dalforistin, Erythromycin, Trimethoprim and Sulfonamides.	PTS of 2nd Round-5 of EQAsia Matrix	of EQAsia

Financial resources and budget: Two projects= Rs. 0.777 million

v. Animal Health Program (AHP)

Project1: Epidemiology and Control of Brucellosis in Pakistan (AS-074)
The prevalence of brucellosis in peri-urban herds of two regions i.e., Islamabad Capital Territory (ICT) and Azad Jammu and Kashmir (Muzaffarabad, Mirpur and Bhimber) was 33.75% and 31.1%, respectively.
Project 2: One World-One Health: Holistic and Cost-effective approach to counter Brucellosis in sheep/goats in Pakistan (AS156)
The overall prevalence of brucellosis in small ruminants of Azad Jammu and Kashmir and Khyber Pakhtunkhwa was 1.32% (n=376). The prevalence of brucellosis was higher in sheep (10.3%) compared to goats (0.57%).
Project 3: Preparation and evaluation of bovine serum and chicken egg derived immunoglobulins for the treatment of *Staphylococcus aureus* mastitis in cattle and buffaloes (PSF)
Staphylococcus aureus bacterin was prepared using Montanide. The safety of the bacterin was assessed in rabbits (n=5). The bacterin was found safe in rabbits. Homogenization of antigen toxoid with Montanoid Adjuvant.
Project 4:Field validation of a newly developed homologous Lineage thermotolerant Peste des Petits Ruminants (PPR) vaccine for control of PPR (AS385)
Quality control procedures for PPR vaccine development were standardized. For this purpose, a sterility test was undertaken. The vaccine strain was found to be free of any bacterial and fungal contaminants.
Project 5:Development of models for control of Warble fly in Pakistan(AS340)
A questionnaire was designed to collect epidemiological data to assess warble fly prevalence in Pakistan. A survey was conducted in Dera Ismail Khan and Quetta to assess the current situation of warble fly infestation (WFI). Only four cases of WFI were observed in these areas

Project 6: Genetic and Antigenic characterization of foot and mouth disease (FMD) viruses for development of improved and potent vaccines
Sixteen FMD viruses were recovered from 51 epithelial cells/ samples collected from cattle and buffaloes in Quetta, Balochistan and characterized as "serotype O".
Financial resources and budget: ALP Projects = Rs. 28.896million

iv. Livestock Research Station (LRS)

Project 1:Evaluation of crop residue based total mixed fermented ration for ruminants (ALP)
• An experimental trial on feed intake and weight gain has been conducted in cattle calves (n=10) at Rawat area. • The results revealed that average total weight gain was higher in the calves fed on TMR-Beet pulp silage than those fed TMR-Wheat strawbased diet (52.5 vs 47.6 kg). • The feed cost per unit of weight gain of calves fed TMR with beet pulp silage was lowest (Rs 192.98 vs 214.99) compared to TMR with wheat straw.
Project 2:Refinement of Feedlot Fattening Rations for Cattle and Buffalo Calves under Different Feeding Systems (PSDP sub project)
• The data on feed intake and weight gain has been recorded on 15 postweaned calves with 3 treatments. • The average total body weight gain (BWG) and dry matter intake (DMI) were improved with the TMRs containing Beet pulp silage (BWG: 71.40 kg, DMI: 5.62 kg) followed by citrus pulp silage (BWG: 69.20 kg, DMI: 5.54 kg) and oat fodder based TMRs (BWG: 59.60 kg, DMI: 5.45 kg). • The feed cost per kg gain in calves fed TMR with Beet pulp silage was lowest (Rs. 183.87) followed by those fed TMR with Citrus pulp silage (Rs. 192.65) and Oat fodder (Rs. 204.92), respectively. • In conclusion, Beet pulp silage was better in terms of weight gain and economical benefit in buffalo calves compared to others.
Project 3:Effects of Supplement substituting maize grain with dried sugar beet pulp in a high forage diet on milk yield, milk composition and economics in lactating buffaloes

- The feeding trial on buffaloes (n=15) has been completed with 03 treatments i.e., 0, 10and 15%levels of supplements substitution with dried sugar beet pulp (DSP).Average milk production was highest in the treatment group with 10% level of supplement substitution with DSP.
- A Seminar/Workshop was arranged on 30thDecember, 2022 to disseminate the salient findings.

Financial resources and budget: ALP project = Rs. 1.085 million

v. Animal Nutrition Program (ANP)

Project1:Improving productive performance of backyard poultry through propagation of superior hybrid poultry birds (PSDP sub-project)

- The parent flock around 200 birds of different breeds (Black Australorp, Rhode Island Red, Hybrid Nacked Neck) was maintained at poultry farm.
- Around 120 sets (5 hens + 1 cockerel per set) i.e., 720 birds were distributed among farmers at a subsidized rate through LDDB.
- One trial on parent flock to evaluate egg production performance of different breeds with commercial vs home-mix feed was completed.
- Results revealed that egg production of birds in all breeds was higher on commercial feed (58.3%) compared to home mix (54.6%). There was non-significant difference in egg mass per bird (4.54kg) and cost per kg (Rs.267) egg mass production between commercial and homemix feed groups. Although egg production was higher on commercial feed however, egg mass production per bird and feed cost per kg suggest that backyard poultry can be reared economically on simple home mix feed consisting of grains and meals.

Rearing of parent stock

Project 2: Characterizing *Aspergillus flavus* from cotton fields to improve environmental, feed and food safety (NAS-USA)

- In total 60 samples of soil, cottonseeds and cake were collected from different cotton growing regions of Punjab and Sindh.
- Over 20 isolates of *Aspergillus flavus* were obtained from these samples and examined morphologically and subjected to aspergillic acid and aflatoxin production tests.
- Fouratoxigenic isolates have been identified. These isolates are being characterized using PCR.

Financial resources and budget: PSDP = Rs. 4.85 million

National and international linkages:

- National Linkage has been developed with Indus hospital & Health Network, Karachi and FAO to uplift the livelihood of livestock farmers through modern reproductive techniques.
- National Linkage has been developed with National Probiotics Lab, NIBGE, Faisalabad.
- National Linkage has been developed with Punjab Fisheries Department and Fisheries Development Board
- Developed linkages with PMAS Arid Agriculture University Rawalpindi and Provincial Livestock and Dairy Development Departments regarding ALP and PSF funded projects.
- National Linkage has been developed with FAO and Livestock and provincial Dairy Development Departments.
- Established linkages with National Academy of Science, USA and Livestock Dairy Development Board, Islamabad

Annual planning meetings:

- Consultative meeting of the national laboratory networking group of animal health (NLNG-AH) held on 27thSeptember,2022 in Islamabad.
- Consultative meeting of the national laboratory networking group of animal health (NLNG-AH) held in May, 2023 in Islamabad.
- Consultative meeting of the national laboratory networking group of animal health (NLNG-AH) held on 27thSeptember,2022 in Islamabad.
- Consultative meeting of the national laboratory networking group of animal health (NLNG-AH) held in May, 2023 in Islamabad.
- Total 14 planning meetings were conducted/attended.
- Two planning meetings were conducted/attended.

Public Private Partnership:

MoU signed:LOI was signed between PARC and Royal Cell Biotechnology, Pakistan to "Optimize and Standardize the In-Vitro Fertilization and Embryo Transfer Technologies in Water buffalo".

Technology transfer:

- One day National Training Workshop was conducted for academicians, researchers and field veterinarians on Laparoscopic AI in Goats under ALP project.
- Mono sex all male tilapia seed transferred to farmers
- Capacity building/training of provincial veterinarian for isolation, identification and antimicrobial susceptibility testing for *E. coli*, *Salmonella* and *Campylobacter* under Fleming Fund.
- Distributed 120 sets (720 birds) of improved hybrid Naked-Neck breed among farmers.
- Interns (n=24) from different universities were provided hands on trainings and livestock visitors/farmers/students (n=250) were advised regarding feed formulation and feeding of dairy and fattening animals and poultry.
- A seminar was organized at Livestock Research Station, ASI, NARC, Islamabad on 30th, December 2022 to disseminate information to farmers regarding use of crop residue based total mixed fermented ration for ruminants.

Knowledge generation and management:

22 research Articles Published in Peer-Reviewed International Journals.

Visit of diplomats/dignitaries to research facility:

- Visit of Chinese delegate from Royal Cell Biotechnology& research Plan Meeting with ARGP/ASI Scientists
- Visit of Indus Hospital & Health Network Team at Small Ruminant Farm, ARGP, ASI, NARC
- Demonstrating the Modern Reproductive Facilities to ALP Officials at ARGP, ASI
- Demonstrating the Modern Reproductive Facilities to Livestock Officials from all over the country at ARGP, ASI
- Representative from World Organization for Animal Health visiting Animal Health program

SOCIAL SCIENCES DIVISION:

The Social Sciences Division of PARC operates through a network of five research establishments called Social Sciences Research Institutes (SSRIs) located at NARC Islamabad, four at the provincial Agricultural Research Institutes and

Muzaffarabad, AJK. The major functions of these institutes are to generate information updates for the biological scientists of their respective provincial Agricultural Research Institutes (ARIs) on the food and nutritional security, rural agricultural transformation, policy analysis and support, agricultural trade and impact assessment of NARS tested technologies. Besides that, SSD closely work with its technical Divisions at PARC. Moreover, under its thematic research agenda, SSD also conducts research on the socioeconomic issues and problems of regional and national importance.

The salient activities f SSD during 2022-23 are as under:

- During 2022-23 SSD conducted almost 25 research studies and different assignments to address the issues of agriculture of Pakistan. These studies had focus on crop diversification, climate change, Food security and impact assessment.
- On the policy side Social Scientists are providing the Daily prices of Wheat flour in different markets of Islamabad/Rawalpindi to MNFS&R to monitor the wheat flour prices.
- SSD also drafted a report on 'Impact assessment of flood: 2022' to identify various windows for rehabilitation of agricultural sector and estimated the damages and losses to crops, livestock, agricultural inputs and machinery for MNFS&R, beside that SSD is also part of PSDP Projects of Wheat, Rice, Sugarcane and Pulses under Prime Minister's Agriculture Emergency Programme.
- SSD has played its role in local and foreign projects. Under ALP 3 Projects were executed while 2 projects were funded by ACIAR.

Some SSD research studies are finalized while the other are at various stages of their execution. In the following paragraphs, some of the completed studies are briefly described.

- **<u>Virtual Water Trade in Pakistan</u>**

Virtual water trade is the hidden flow of water in food or other commodities that are traded from one place to another. In Pakistan, unsustainable consumption, over-extraction, and climate change have put additional pressure on water sustainability. Water crisis is putting the largest sector of the country's economy at risk. The major crops of Pakistan (Rice, Wheat, Cotton, Sugarcane, and Maize), fruits, and vegetables are the main consumers of agricultural water and contribute the most to the domestic virtual water trade among provinces. In the recent past, virtual water trade has received much attention and has become an important tool for balancing water budget at regional as well as international levels.

On the other hand, virtual water trade may also adversely affect the exporting region/country's water balance and the economy. In this study, virtual water trade was analyzed based on data from secondary sources for major crops. The research results provided the magnitude and direction of the virtual water trade in Pakistan. The Khyber Pakhtunkhwa province was found to be a net importer of 9168 million cubic meters (Mm^3) of virtual water (rice 600. wheat 3652, sugar 413, fruits 354 and vegetables 733 $Mm^{3)}$ from other provinces. Similarly, Sindh province was a net importer of 2616 Mm^3 of virtual water (maize 1807, fruits 37 and vegetables 775 $Mm^{3)}$ from other provinces. Balochistan province was a net importer of 1090 Mm^3 of virtual water (wheat 27, sugar 640, and maize 423 Mm^3) from other provinces. It is suggested that clustering of agricultural commodities may be encouraged based on the comparative advantage each province has, to make best use of water available to each province. Low water availability regions need to specialize in high value crops that could be exported to other provinces.

- **Recommended Technologies and Farm Practices of Major Crops in Context of Decreasing Profitability in Punjab Province of Pakistan**

Pakistan has been experiencing stagnating yields for quite some time. There has been a belief that one of the reasons for low yield is lack of knowledge of modern production practices available to a majority of the farmers. To measure this factor of knowledge gap and the difference in profitability of farmers adopting recommended modern production packages and those not following these, this study was designed. In the year 2022-23 there was a difference of about thirteen percent in the cost of existing and recommended production packages of sugarcane crop. Furthermore, investment gaps were found to be inversely related with farm size. Mean knowledge gap of the growers was 59 percent. Sugarcane growers have low to medium knowledge gaps about recommended production package of the crop. As far as adoption of the production practices is concerned, land preparation practices for crop sowing, seed rate and fertilizer application were moderately adopted vis-à-vis recommended levels. While, seed treatment, irrigation application and disease control are poorly adopted by the growers. However, chemical weed and insect-pest control practices were comparatively better adopted.

In case of Cotton, there was a difference of about thirteen percent in the cost of existing and recommended production packages of the crop. Investment gaps between recommended and existing production packages were 7.6, 21.1 and 5.21 percent at, small, medium and large farms, respectively. Mean knowledge gap of the cotton grower was 46 percent. Most of the farmers had medium level of knowledge about recommended production practices. Adoption of recommended chemical weed control practice was comparatively better adopted than other practices. Land preparation and fertilizer application practices were partially adopted by the farmers,

while, adoption of recommended seed rate, its treatment before sowing and irrigation practices was poor. Thus, concerted efforts through extension and financial services are required to enable farmers to improve adoption of recommended practices.

For rice crop, the survey covered the Kharif season of the year 2021. The cost difference between existing and recommended production packages was about 13 and 12.5 percent in costs of fine and coarse varieties, respectively. The investment gaps varied based on farm size. The average knowledge gap among rice farmers was 45.4 percent, increasing with farm size. Regarding spring maize crop, field surveys in Okara, Sahiwal, and Chiniot districts in 2022 showed that the gross cost of cultivation at sample farms was about 11 percent less than the recommended production package. Maize growers had a mean knowledge gap of 25.8 percent regarding the recommended production package, with small farms showing higher knowledge gaps. For wheat crop in the Rabi season of 2020-21, the study focused on rice-wheat and mixed cropping zones. The cost difference between existing and recommended production packages was around nineteen percent. Investment gaps were observed to be higher at medium farms and lower at large farms. The average knowledge gap among wheat farmers was 53 percent. This research highlights the need to bridge the information gap and provide assistance to enhance investment for farmer to enable them to adopt recommended production packages of major crops. By addressing these gaps, farmers can possibly achieve potential yields of major crops in the province.

- **Crop Diversification in Pakistan**

Agricultural diversification is considered vital mechanism for risk aversion, both at foreign and national levels. This study aimed to determine the crop diversification in Pakistan. To capture the variations in provinces, crop diversification indices were computed for four provinces of the country. Temporal changes in diversification over four decadal intervals, 1990-91, 2000-01, 2010-11 and 2020-21 were analyzed based on secondary data. The study revealed that Pakistan's agricultural sector is still concentrating in favor of cereals crops. Cereals crops exhibited positive growth rate in area which validated decreasing trends in crop diversification. Crop diversity was at low level in 2020-21 as compared to 1990-91s in Pakistan. There are variations among provinces in the extent of crop diversification. Punjab has remained more diversified than other provinces. However, temporal comparison between 1990-91 to 2020-21 demonstrates that the extent of crop diversification has decreased in all provinces except in Balochistan. There was an increase in crop diversity in Balochistan province over the whole period under analysis. Sindh also registered increase in crop diversity during 1990-91 to 2010-11 followed by a slight decrease after that. Temporal decrease was noted

in Khyber Pakhtunkhwa (KP) and Punjab provinces with slight improvement in Punjab after 2010-11. There is little diversification in Sindh and Khyber Pakhtunkhwa towards horticultural commodities. These results show that there was ample room to increase crop diversity in country. From policy perspective, there is a need to identify evidence-based understanding of factors that facilitate the process of crop diversification. A comprehensive study is needed to examine the determinants of cropping pattern diversification, and evaluates the role of crop diversification in increasing farm income and overall growth of the country.

- **Impact Assessment of Project Interventions under the Project "Increasing Productivity and Profitability of Pulses Production in Cereal-based Cropping Systems in Pakistan**

In the agricultural sector, innovations and their adoption have a significant impact on profitability and productivity. The impacts of innovations with or without their adoption, provide valuable information for decision makers. This study was designed to explore the impact of various interventions introduced under the Pak-Australia collaborative pulses project. The project introduced the different intervention to address the pulses production constraints in six sites at framer's fields in Pakistan. The farmer-led research approach has adopted to enhance the pulses' productivity and profitability. The project interventions focused on providing certified seeds, improved pulses production technologies and better crop management practices. To assess the impact of these interventions on both beneficiary and non-beneficiary farmers across Pakistan, a study was carried out, and primary data was collected from 219 pulses farmers, including 1st stage beneficiaries, 2nd stage beneficiaries, and non-beneficiaries in the six project sites. Currently, on all the project sites beneficiary farmers had certified seed that was treated with rhizobium Inoculum and fungicides. The certified seed was provided by the project staff, fellow farmers and village-based seed banks. Chickpea fields were found to be weed-free and farmers had the knowledge and applied preemergence weedicides to control the weeds which reduce labor cost and increased farm profitability. However, attack of pod borer was found even after use to insecticide and the disease root rot, was also observed. The farmers reported issues like availability and accessibility of inputs including seed fungicides, and insecticides. Private sector players including input suppliers and potential service providers can play an active role in increasing productivity by timely provision of inputs and entering the value addition part of the value chains.

- **Potential Repercussions of Increasing Area under Export Crops in Pakistan**

This study was conducted to produce evidence on different aspects of area expansion under export crops of Pakistan, specifically the net gain from area expansion in relation to trade-off with other competing crops in Pakistan. The analysis revealed that rice is not competitive to maize and sugarcane crops as the net gains are negative. Moreover, reducing maize area can convert it from an export crop to the status of import crop and the country would have to import maize for domestic needs, which will cost even more. Rice is competitive to the cotton crop with positive net gains. However, keeping in view the importance of cotton-based textile industry in earning country's foreign exchange reserves, it may not be feasible to further reduce cotton area which is already declining due to many factors. Moreover, if cotton area declines, country may have to import more cotton for its textile industry and it would cost more due to higher global prices and additional transportation costs. Beside the economic aspects, there are other elements that are also needed to be considered regarding rice export enhancement including low productivity, loosing competitiveness especially in case of basmati, and contamination issues. It concludes that increasing rice area is not viable option rather productivity enhancement and export market diversification should be focused to increase rice production and exports instead of area expansion.

Economics of citrus was found promising as compared to rice, cotton, and maize crops but not so good in case of sugarcane. However, citrus supply chain across Pakistan has faced diminishing returns over the time. Multiple factors are considered responsible for this including inadequate technical support, non-availability of improved varieties, infestation of diseases and abrupt climatic changes are stressors for the supply chain. Other hindering factors include low density and low productive citrus orchards, primitive management practices, inadequate storage facility, limited processing, lack of certification and branding, non-compliance of SPS protocols and lack of certifications. Poor quality followed by adoption of traditional packaging practices appear to be detrimental for higher returns in international market. Citrus area expansion is viable in economic terms but it is suggested that the hindering factors especially post-harvest losses (up to 40%) in the citrus value chain should be dealt first before thinking to expand the area.

Mango area expansion is profitable in Punjab where yields are higher as compared to Sindh areas. However, the country has been facing a declining exportproduction ratio due to quality issues and gradual decline in country's competitive position in the world market. Therefore, despite positive net gains of mango area expansion, it cannot ensure the export. It is suggested that hindering factors should be considered before planning for mango area expansion. Moreover, Pakistan's mango exports is concentrated in a few countries with low-end markets,

due to which Pakistan receives the lowest export price despite some recent improvement in mango value chain. It is proposed that market diversification should also be focused by entering the high-end markets.

- **An Assessment of Yield Differential in Maize Crop by Local Hybrid and Multinational Hybrid Seeds**

Maize is the third important cereal crop in Pakistan and is mainly used for food, feed and fodder. Its area, production and yield have increased tremendously overtime in the country. The increase in area is attributed to introduction and later spread of spring maize while yield increase mainly results from the adoption of imported hybrid varieties. The present study was undertaken in the year 2022 to assess the adoption and yield performance of local hybrid maize seed versus multinational companies' (MNCs) hybrid seed. A total of 80 farmers were interviewed from two maize growing districts (Faisalabad and Chiniot) of the Punjab province through structured questionnaire. The data collected through formal survey was edited and analyzed using descriptive statistics in conjunction with relevant literature to provide useful insight about adoption and yield performance of maize cultivars in the selected districts of Punjab. It was found that almost all the farmers grow MNCs hybrid seed in both the seasons. The MNCs seeds give good results in terms of yield and quality as compared to local hybrid seeds. The results revealed that Pioneer Company maize varieties (P1429 and P4040) were the major cultivars grown in spring and autumn season respectively. The 100 percent respondents reported that MNCs maize hybrid seed gave higher yield in comparison with local hybrid seed. The price of local hybrid seeds was lower as compared to MNCs seeds. There is need to develop local hybrid seeds with higher yield and quality characteristics.

- **Study of Dietary Patterns and Nutritional Status: The Case of Employees Working at Ayub Agriculture Research Institute (AARI) Faisalabad**

According to concerns of Government of Pakistan on overweight and obesity and the resultant negative effects of bad health on working capacity of the labor, present study was conducted to estimate the general body health status of public sector employees working in agriculture sector. As the individual's diet plays a central role in determining nutritional status, therefore, primary data on daily consumption of different food items during 2022 was collected from 325 adult employees comprising both male and female employees at AARI, Faisalabad. The objectives include the study of knowledge about healthy foods and foods eaten in reality, the estimation of dietary diversity scores and body mass index, a common measure of body health derived through height and weight. Results revealed that overall average weight of respondents is 74 kg while average height is 1.66 meters which translates to overall BMI of 27. According to WHO guidelines for adults, the estimated BMI value implies that both the genders are at least over-weight. Although

majority falls under healthy BMI category yet combined percentage of overweight and obese employees is worries some enough to invite attention of public health and nutrition experts to overcome problems of overweight and obesity. Females of non-officer rank and males of officer rank are in the danger zone on account of poor health and more severity of over-weight and obesity. Both the genders, out of 7 defined food groups, ranked cereals and cerealbased products as the healthier dietary food group followed by vegetables and meat/pulses/eggs groups. However, in reality, eaten food groups show that cereals, meat and vegetables are first, second and third food groups in their daily dietary pattern. Consumption of items under fruit group is meager. Overall dietary diversity score (O-DDS) is almost same but dietary diversity scores estimated for breakfast and dinner timings are different for males and females with males having relatively better mean DDS for dinner time and females having relatively better mean DDS for breakfast time. Another finding is that BMI and salary variables move in the same direction implying that as salary is improved, health status may be ameliorated (by eating healthy foods) and vice versa. Similarly, study concludes that as diets are improved (diets become healthy), there may be less chances of being obese (by declining BMI). Hence, public health and nutrition departments should attend public sector employees to guide them about healthy foods and healthy life styles from working to night sleeping.

- **Adoption and Prospects of Sugarcane Planter in Punjab**

Sugarcane is a tropical crop that is cultivated mainly in Punjab followed by Sindh, and Khyber Pakhtunkhwa. It provides raw materials to the 2nd largest agrobased sugar industry in the country. On one hand, sugarcane sowing is a laborintensive and time-consuming activity and on the other side, the cost of labor in the country is growing rapidly, and farmers even face labor shortages. Moreover, the manual sowing of sugarcane did not follow the recommended sowing protocols, such as row-to-row distance, proper placement of seeds, and fertilizers, which ultimately reduce the per acre yield, posing a loss to the national economy. Farmers need to alter sugarcane production methods from manual sowing to mechanical sowing to harness the available potential in sugarcane. Keeping in view the role of farm mechanization, the federal government supported the supply of imported and local farm machinery and equipment in the country. Mechanized sowing of sugarcane helps in the timeliness of operations and human labor reduction, decreases the cost of operation, helps in enhancing the quality of work, and guarantees effective exploitation of resources. The present study was designed to explore the adoption and prospects of a newly introduced sugarcane planter in selected areas of Punjab. The results of the study suggest that sugarcane planter sowing saves crops from lodging and saves irrigation water by approximately 2030 percent as compared to traditional sugarcane sowing methods. Moreover, this technology also helps farmers perform better and easier intercultural practices due to proper line sowing of

the crop. Most adopter farmers reported that this technology improves the quality of the cane manifold owing to proper ventilation of the crop. Adopter farmers reported comparatively more yield of 150-200 monds and less irrigation time per acre. Thus, sugarcane planter saves time and overcomes the labor shortage problem by reducing the sowing cost up to 30-40 percent and ensures 100 percent planting of seeds compared to traditional manual sowing methods. The shortfall of this technology reported by farmers is that the row-to-row distance should be 2.5 feet instead of 4 feet because it leaves lots of empty space around the side of the field as the farmers plant this area manually after sowing with a planter. Second issue is the requirement of tractor with highpower (approximately 385 HP) to drag the sugarcane planter owing to the heavy weight of the planter. Moreover, the cost of the sugarcane planter also increases manifold in current inflation as most of the parts of this machine are imported, so this technology is only limited to progress farmers for their personal use. It is suggested that government should facilitate the agricultural service providers in the sugarcane growing areas to purchase and provide services to subsistence sugarcane growers by reducing at least fuel prices.

Research Studies 2022-23

- Virtual Water Trade and its Implications on Water Use Efficiency and Sustainability in Pakistan
- Mapping Dietary Diversity in Pakistan Over Time by Districts and RuralUrban Divide
- Economics of Alternative Crop Enterprises in Punjab, Pakistan
- Crop Diversification in Pakistan
- Maize area Expansion: Impact on Competing Crops
- Impact of area expansion under oilseed crops: Possible repercussions
- Potential of Sugar Beet as a Source of Sugar
- Forecasting Production of Essential Food Crops
- Evaluating genetic diversity in Mash Bean and Soybean Accessions using Multivariate Analysis
- Understanding, Integrating and Mainstreaming Gender into Vegetable Value Chains in Pakistan: An ex- post analysis of SVVCP
- Assessing Social Vulnerability to Flood 2022 of Selected Rural Communities in Pakistan
- Potential repercussion of increasing area under exports crops
- Rural development in Pakistan: A review
- An analysis of Crop Diversification amongst smallholder farmers in Khyber Pakhtunkhwa, Pakistan
- Fruit flies: Management and losses in vegetable crops in Central Khyber Pakhtunkhwa

- Household Dietary Diversity, Food Security & Nutritional adequacy among the small farmers of Sindh
- Socio-economic analysis of small ruminant livestock production in District Kohistan, Sindh province
- Assessment of Yield Differential in Maize Crop by Local Hybrid and Multinational Hybrid Seed
- Adoption and prospects of sugarcane planter in Punjab
- Exploring Linkages Between Agricultural Work Performance of Cotton Pickers and Nutritional Status in Punjab Province
- Economic Analysis of Different Maize Cob Harvesting Mechanisms in Punjab
- Study of Food Preferences and the Nutritional Status by Gender and Job Cadre: Evidence from Ayub Agriculture Research Institute Faisalabad.

Projects:

- Flow of price information among the major markets of Punjab, Pakistan (ALP Funded)
- Crop-Livestock Integrated Farming Systems in Irrigated Punjab: Livelihood, Employment and Food Security Linkages (ALP Funded)
- Recommended technologies, farm practices of Major crops, decreasing profitability in Khyber Pakhtunkhwa (ALP Funded)
- ACAIR Funded Project: Developing Competitive and inclusive Value Chains of Pulses in Pakistan
- ACAIR funded Project: Understanding the drivers of successful and inclusive rural regional transformation: Sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan

PLANNING & DEVELOPMENT DIVISION:

1. Research Agreement (MoU type) Projects:

Overall, 19 research agreement projects (MoU type) were ongoing during 2022-23. The MoU section of PM&E has processed and revised administrative approval of 16 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), 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), Livestock & Dairy Development Board (L&DDB), Pakistan National Commission for UNESCO PNCU, Ministry of Federal Education & Professional Training, German Academic Exchange Service (DAAD).

MoU type projects implemented in 2022-23

Plant Science	Animal Science	Natural Resources	Social Science	Agricultural Engineering	Total
12	01	03	03	0	19

The MoU section has also processed 22 projects proposals and concept papers to different local and international donors like Korean Rural Economic Institute, NSLP (PSF), German Academic Exchange Service (DAAD), Saudi Arabia etc. As 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 organization are underway for implementation in the future.

2. In-House Review of ALP Projects.

In order 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 2022-23, 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 resourses**	**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.

3. On-Site Evaluation of Projects.

PM&E directorate evaluated the following two PSDP projects.

- Strengthening/Up-gradation of AZRI, Umerkot, Sindh
- Updation of Agro Ecological Zones of Pakistan through Satellite and In-situ Data Mapping
- On-site M&E conducted for project titled "Updation of Agro Ecological Zones of Pakistan through Satellite and In-situ Data Mapping" at (CWERI, NARC) on 12-06-2023 and M&E report prepared and submitted to Chairman, PARC
- On-site M&E conducted for project titled "Develop an Innovative Technique for Processing the Olive Fruit Waste to Achieve Leftover Oil for Edible Use" at (NUST, Islamabad) on 13-06-2023 and M&E report prepared and submitted to Chairman PARC.

PUBLIC SECTOR DEVELOPMENT PROGRAM

Functions of PSDP Directorate (P&D Division), PARC

- Development and formulation of multidisciplinary R&D projects
- Appraisal/scrutiny of projects
- Processing development projects with M/o NFS&R and Planning Commission for approval at competent forums
- Preparation of Public Sector Development Program (PSDP) for budget allocation
- Presenting and defending budget demand at different forums i.e. Standing committee, Priority committee, APCC, NEC
- Preparation and processing of annual work/cash plan and PSDP progress
- Organize review meetings at PARC, M/o NFS&R and M/o PD&SI
- Other project related activities

Performance FY 2022-23:

- Two (02) PSDP projects were completed titled. (i) "Strengthening/Upgradation of AZRI, Umerkot, Sindh" and (ii) "Updation of Agro Ecological Zones of Pakistan" through "Satellite and In-situ Data Mapping" during FY 2022-23.
- Five (05) project proposals under the Islamic Development Bank (IsDB)'s Food Security Program were submitted for funding to Ministry of National Food Security & Research (M/o NFS&R).
- Twelve (12) Project proposals for financial support under the Pakistan Innovation Fund (PIF) submitted to Ministry of Planning, Development & Special Initiatives.
- Eleven (11) PSDP project proposals were submitted to M/o NFS&R for approval of competent forum (CDWP, DDWP, ECNEC).

- Three (03) New PSDP projects titled "(i) Pakistan-Korea Joint Program on Certified Seed Potato Production System, (ii) Prime Minister's Initiatives for Green Revolution 2.0 and (iii) Horticultural Support Program" were approved by the Central Development Workng Party (CDWP) fof FY 2023-24.
- Three (03) Project Proposals under Public Private Partnershi (PPP) mode 202324 submitted to M/o NFS&R.
- Six (06) Project Proposals have been prepared in collaboration with Technical Division for research funding from the Bank of Punjab.
- Prepared/ approved online Cash Plans and Work Plans of nine (09) On-going PSDP funded projects.
- Conducted one (01) Steering Committee and two (02) Technical Committee Meetings during FY 2022-23.

The Details of Financial Performance of PARC – PSDP On-going Projects during FY 2022-23:

(Rs in million)

Name of Project	**Total Cost**	**Budget**	**Revised Budget**	**Release**	**Expenditure as on 30.06.2023**
Commercialization of Potato Tissue Culture Technology in Pakistan	158.830	44.130	43.626	43.626	43.343
Productivity Enhancement of	15789.402 *(3750.660)******	270.000	200.100	200.100	199.912
Rice					
Productivity Enhancement of Sugarcane	4937.225 *(1003.773)******	130.000	104.800	103.145	103.079
Productivity Enhancement of Wheat	30455.353 *(5632.774)******	350.000	254.257	254.257	254.054

Promoting Research for Productivity Enhancement in Pulses	1437.358	400.000	216.697	216.697	216.686
Sino-Pak Agricultural Breeding Innovations Project for Rapid Yield Enhancement	433.936	99.598	74.983	74.763	72.701
Strengthening/Up-gradation of AZRI, Umerkot, Sindh	528.260	145.000	140.801	140.801	134.316
Updation of Agro Ecological Zones of Pakistan through Satellite and In-situ Data Mapping .	60.450	20.000	15.003	15.003	12.266
Mainstreaming of Mountain Agricultural Research Centre (MARC) for the Promotion of High Value Agriculture in Gilgit-Baltistan	288.200	40.000	32.054	32.054	32.054
TOTAL :	**54089.014**	**1498.728**	**1082.321**	**1080.446**	**1068.411**

* PSDP Share.

1. ***AGRICULTURAL LINKAGES PROGRAM (ALP)***

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 2022-23 as part of the Agricultural Linkages Program (ALP) are outlined as follows:

- 118 projects were actively underway, benefitting from funding provided through the Agricultural Linkages Program (ALP).

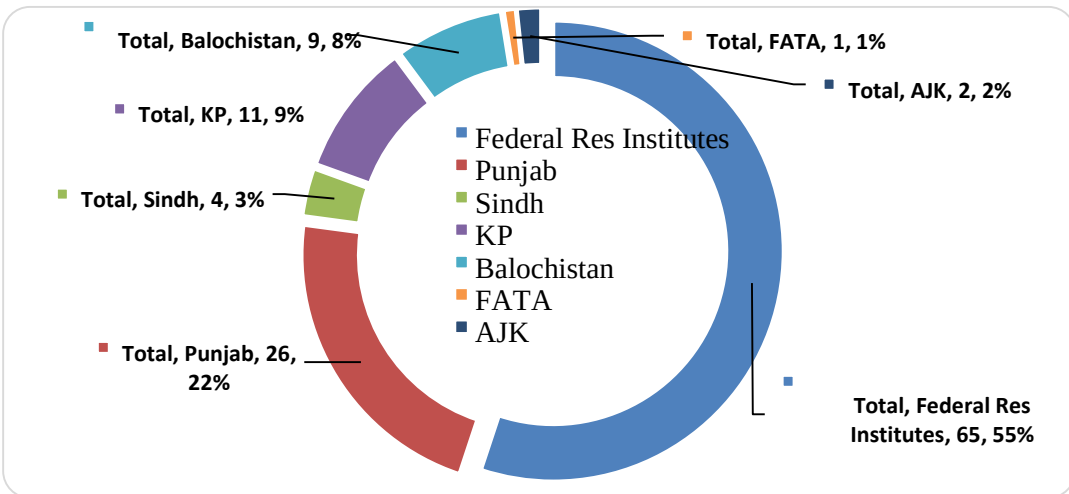


Figure 1. Region-wiseof on-going projects

- Geographical distribution data is illustrated in Figure 1, showcasing the allocation of projects across different regions.
- Figure 2 provides insight into projects' distribution across various disciplines.

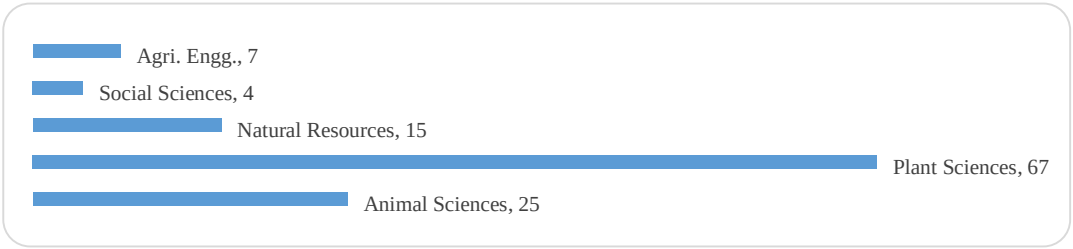


Figure 2. Discipline-wise on-going projects

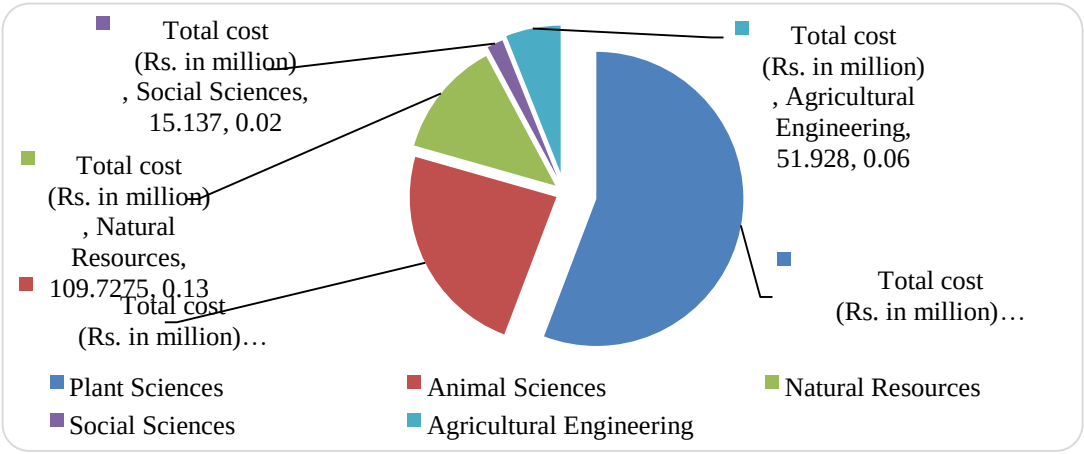


Figure 3. Discipline-wise approved budget of on-going projects The combined approved budget for these projects amounted to Rs 858.255 million (Figure-3).

- During the fiscal year 2022-23, a total of 30 projects 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, 07 in Animal Sciences, 06 in Agricultural Engineering, 05 in Natural Resources, and 02 in Social Sciences.
- The collective expenditure for these endeavors amounted to Rs. 179.35 million (Figure 4), drawn from the Agricultural Linkages Program (ALP).

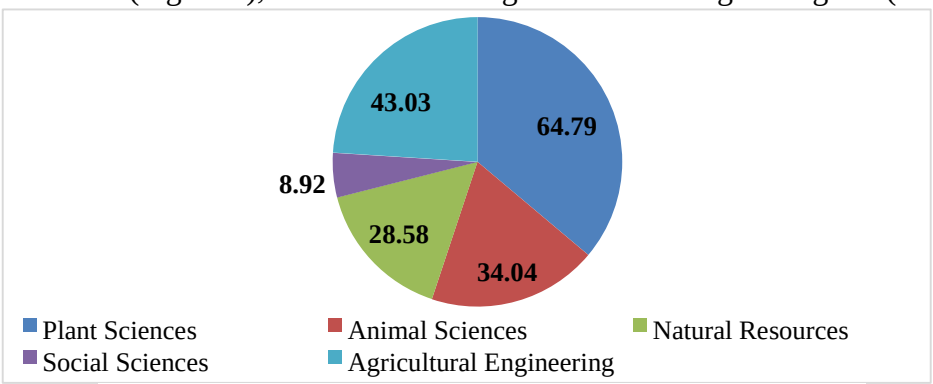


Figure 4. Discipline-wise approved budget of completed projects

- The ALP Secretariate ensured the seamless flow of funds by processing and releasing necessary funds in a timely manner.
- During year 2022-23, an in-house review of 43 ALP funded on-going projects was conducted:22 in Plant Sciences, 10 in Animal Sciences, 05 each in Agricultural Engineering, Natural Resources, and 01 in Social Sciences.
- For the 10th batch of Agricultural Linkages Program, discipline-wise Research Priority Areas finalized and got approved from the Board of Directors of ALP.
- Subsequently, the announcement was made in the newspapers (Figure 5) and on PARC (http://www.parc.gov.pk/) and ALP (https://alp.gov.pk/) websites.
- In response, 2642 preliminary proposals/concept papers received through online software/web portal (http://111.68.96.148/batch10/). These proposals are being scrutinized for further processing

Government of Pakistan

PAKISTAN AGRICULTURAL RESEARCH COUNCIL
ISLAMABAD

INVITATION OF RESEARCH PROPOSALS UNDER AGRICULTURAL LINKAGES PROGRAM (ALP), PARC

Pakistan Agricultural Research Council (PARC) invites Research Proposals (Concept Papers) under 10th batch of **Agricultural Linkages Program (ALP)** from the Pakistani research scientists for the award of research grants on highly competitive basis.

The research proposals should be in line with the identified research priorities in the fields of Plant Sciences, Natural Resources, Animal Sciences, Social Sciences and Agricultural Engineering. These research priorities can be downloaded from PARC/ALP website <http://www.parc.gov.pk>/<http://www.alp.gov.pk>.

The preliminary proposal (concept paper) should be submitted **online on web portal within one month from the date of published advertisement alongwith one hard copy of the proposal via surface mail to the following address.** Proposals submitted after due date will not be entertained.

PID(I)6781/22

Executive Director (ALP)
PARC, Plot 20, G-5/1, P. O. Box 1031. Islamabad,
Ph: (051) 9245648, Fax: (051) 9202150

Announcement of ALP 10th Batch

AGRICULTURAL ENGINEERING DIVISION:

The Agricultural Engineering Division's key focus is to design, develop, adapt and promote energy-efficient and precision agricultural machinery with a particular focus on introduction of farm mechanization and postharvest technologies for cereal, fruits, vegetables and other crops. Division is also playing an important role of coordination among the stakeholders related with the promotion of agricultural mechanization in the country. The division is also providing technical inputs for development of National Standards for agricultural tractors & machinery and establishing facilities for testing of agricultural machinery.

Agricultural Engineering Institute (AEI) is a leading national institute, working under the umbrella of Agricultural Engineering Division (AED), PARC where research is conducted to promote agricultural mechanisation in the country through design, development, adaptation and commercialisation of appropriate agricultural machinery by involving public and private sectors. The focus of research at AEI is demand-based and demands always are raised by the end-users and reach us through higher channels. During the years 2022-23, research activities on the following areas were conducted by AEI.

Combine Seeder and Pak Seeder machines for rice residue management

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) of Pakistan Agricultural Research Council (PARC) with technical collaboration of M/S Greenland Enginees, Daska has developed a rice residue management technology called as "Combine Seeder", which is the next version of "Pak Seeder" technology. This technology chops the paddy straw and stubbles, incorporates it in the soil and plants wheat crop in a single operation. This technology not only improves soil biological and physical health, but also increases wheat and rice yields from 10-15%. This is a resource conservation technology that can enhance crop yield, reduce nutrients loss of the soil and save environment form smoke pollution. These technologies will help reduce the SMOG problem in the country. Wheat planting trials were carried out at different locations in the Punjab to

see the performance of the machine. Results were compared with the conventional wheat sowing practices. The working capacity of the machine is 0.75-01 acre/h depending upon the residue density in the field.

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Pak Seeder, Combine Seeder and other rice residue management machinery.

Awareness and training field seminar

Agricultural Engineering Institute, NARC, PARC organised a national seminar in Gujranwala on technological solution of rice straw burning. Every year about 16 million tonnes of paddy straw is produced in Pakistan, out of which about 60% is burnt. A large number of farmers, officials of the Punjab Agriculture Department, agricultural machinery manufacturers, representatives of companies providing machinery services to farmers and other stakeholders participated in the event. Relevant package of straw management machines was demonstrated to participants.




Seminar on rice residue management machinery.

Regenerative agriculture

The climate-smart production system that requires significantly less cost outlay and far less inputs is applied to regenerative agricultural practices. This production system is based on natural process of soil fertility. Main elements of this production system include growing crops on raised beds, zero or far less tilling, sowing of crops with precision planter and mulching of sown crop. The system is well known and has been practiced globally for decades, but individually and sporadically. For proper application of regenerative agricultural practices, all these cultural practices should be integrated in the field in a sequence by using proper mechanisation and implements. This production system has already been practiced by many individual farmers in the country and have reported impressive results in higher yields, significantly reduced use of irrigation water and virtually no application of chemicals. However, none of public sector research and development institutions has experimented this system. Agricultural Engineering Institute with active support of Ministry of National Food Security and Research and Planning Commission of Pakistan has conducted a trial on wheat crop and found encouraging results. The bottlenecks in implementation of regenerative agriculture system is the availability of customised agriculture machinery suited to this system from planting to harvesting. The technology is under development phase and needs more field tests and evaluations for its sustainable development.

Demonstration of regenerative agricultural machinery at NARC.

Funding source

The current project is being funded by Public Sector Development Program (PSDP) under Prime Minister's Agriculture Emergency Program.

Target for the year 2022-2023

Sr. No	Planned activities	Planned Target	Target achieved
1	Refinement in Pak seeder / combine seeder and regenerative agricultural machinery	02	02
2	Provision of technical assistance to selected manufacturers for fabrication of combine seeder	03	03
3	Establishment of experimental plots of combine seeder and regenerative agricultural machinery	05	16
4	Data collection	05	13
5	Data analysis	05	12
6	Training of farmers about Pak seeder technology	25	100

7	Field days / demonstrations of technologies to create awareness among farmers and stakeholders	02	02

Productivity Enhancement of Rice – Rice Mechanisation

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 35000-40,000 plants per acre while recommended plant population is around 80,00085,000 plants per acre. This difference is plant population results in low productivity of rice crop in Pakistan. Promotion, awareness and training regarding rice production machinery was provided to farmers under PSDP funded project for productivity enhancement of rice.

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.






Figure 4: Glimpses of field activities to promote rice mechanization.

Awareness and training field seminar

An awareness field seminar on "Rice planting and harvesting machinery" was organized at Daska, Sialkot. Around 150 farmers, manufacturers, service providers like Meskay & Femtee Trading Company, Gujranwala, BMITCO Agro Services, Sialkot, Chairman Sons Zarai Corporation Gujranwala, extension and agricultural officers, policy makers and Assistant Commissioner of Daska attended this seminar. Director General, Agricultural Engineering Division, PARC was the Chief Guest of the event. Speakers from the Punjab and Federal Government trained the participant about using rice specific machinery to enhance rice productivity and reduce losses. The AC of Daska encouraged farmers to focus more on rice crop as it is the main staple food of our country. He further stressed farmers to increase productivity by using modern machinery so that we could earn precious foreign exchange by exporting this crop.

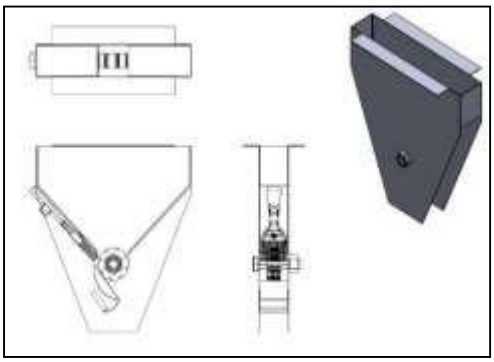
Training to about 120 farmers were provided to farmers / service providers about the key parameters to be understood and noted while using rice machinery. For example, during rice harvesting, the farmers were suggested to check rice straw behind the machinery and check the extent of grain losses in the 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. The stationary type rice nursery raising machinery was optimized for local conditions and was demonstrated to the rice machinery service providers for its efficient utilization.

Field Seminar and training program on rice production machinery.

Development of seed metering mechanism to improve the DSR drill

A new roller type seed metering mechanism was designed and developed at prototype workshop of AEI, NARC. Conventionally the inclined plate type seed metering mechanism is used in DSR drill for direct sowing of the rice in the field. The inclined plate type seed metering results in highly variable plant to plant spacing and seed missing; which affects the plant growth and yield. The new seed metering mechanism will help to maintain the proper plant to plant spacing to improve the

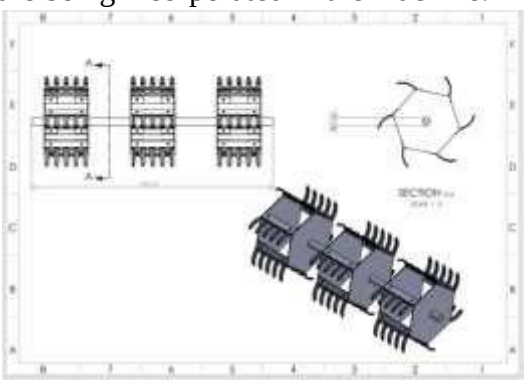
crop yield. The metering unit is being tested and some improvements are being made in it to further enhance its performance.



Design and development of seed metering mechanism for DSR drill

Development of rice weeding machine

A rice weeder machine was designed and developed at prototype workshop of AEI NARC. The self-propelled machine will be used to eradicate the inter-row weeds and will help to reduce the reliance on chemical sprays for weed control. The machine was initially tested for weeding of rice crop in the NARC field area. Some improvements were recorded during the field testing and these improvements are being incorporated in the machine.



Design and development of mechanical weeder for rice crop

<u>Funding source</u>

The current project is being funded by Public Sector Development Program (PSDP) under Prime Minister's Agriculture Emergency Program.

Target for the year 2022-2023

Sr. No	Planned activities	Planned Target	Target achieved

1	Provision of technical assistance to farmers / service providers for rice nursery raising and mechanical transplanting	15	15
2	Optimization of the rice nursery raising machine	01	01
3	Establishment of demonstration plots using mechanical rice transplanter	05	05
4	Performance evaluation of new and reconditioned rice transplnaters	05	06
7	Field days / demonstrations of technologies to create awareness among farmers and stakeholders	02	01

COORDINATION & MONITORING DIVISION:

Coordination and Monitoring Division is mandated to coordinate national and international stakeholders for synergistic efforts of agriculture research efforts to boost agriculture quality production through trained manpower. It consists of two Directorates and one Institute namely; (i) Directorate of Coordination, (ii) Directorate of Human Resource Development and (iii) PARC Institute of Advanced Studies in Agriculture (PIASA), each having its own mandate and objectives. Recently, regional coordinating units were established in PARC outstation establishments at Quetta, Peshawar, Faisalabad, Tandojam, Muzaffarabad and Juglote-Gilgit to coordinate with all the Agriculture Universities and Livestock Departments of provinces, at regional level.

The functions of this Division mainly include; i) Coordination between PARC and national agricultural research systems of many countries (bilateral links), and UN/CGIAR/US based agricultural research agencies (international development partners), ii) Coordination and facilitation of research at national level, and iii) Assessment of training needs (local/foreign) for NARS and arrangement of preservice and in service training along with budget & placement proposals. Furthermore, this Division is also involved in post-graduate education through PARC Institute of Advanced Studies (PIASA).

The Division is also striving for Human Resource Development of the Council and NARS. The main achievements of this Division are as under:

Foreign Meetings (Joint Working Groups/ Joint Economic Cooperation) with Friendly Counties

Provide agenda items, proposals for cooperation, implementation of decisions for Joint Working Meetings, Joint Economic Cooperation meetings and

Regional Cooperation meetings held under Economic Affairs Division, Ministry of Foreign Affairs and Board of Investment with China, Belarus, Kazakistan, Uzbekistan, Azerbaijan, Iran, Kingdom of Saudi Arabia, Ukrain, Kuwait and Russai.

Facilitation for International Projects a.
PARC and KOPIA, Korea

Korea has transferred following technologies/ machinery/ material to Pakistan, as Grant-in-Aid:

- Aeroponic Greenhouse Technology; with State of the art Aeroponic Greenhouses installed at NARC, for virus free, high quality potato seed production
- Advanced post-harvest machinery/ technology for chili crop, to cater the Phytosanitary needs of high end markets for the Red Chilies Powder/flakes export
- Ryegrass cultivars as a high yielding and nutrient rich winter fodder
- 'Pakistan-Korea Joint Program on Certified Seed Potato Production System' has been approved by the Governments of Pakistan and Korea, and Korean side has allocated USD 2.50 million for this project.

b. PARC and CABI

Project on pesticide residues on fresh tomatoes in Punjab through signing of Agreement between PARC and **CABI (UK)**: Plant Wise Plus and Funding Contract

c. PARC and Bank of Punjab

Project on high quality potato seed production

Facilitation in organizing international meetings

Facilitated in Holding following meetings with Foreign and National Delegates:

i. Pakistan-Russia Inter Government Commissions on Trade, Economic, Scientific and Technical Cooperation ii. Pak-China Joint Working Group meeting on agricultural cooperation
iii. 8th Session of Pakistan-Uzbekistan Joint Ministerial Commission
iv. 6th Session of Pakistan-Belarus Joint Ministerial Commission
v. 11th Session of Pakistan – Kazakhstan Inter-Governmental Joint Commission vi. Pak-Italy Joint Economic Commission

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 30 foreign participants of Workshops/Seminars & Internationally Recruited Staff (IRS) of agricultural research organizations, posted in Pakistan.

MOUs/Agreements

Four (04) MOUs/ Agreements with international organizations and 11 national level MOUs/Agreements/LoIs have been signed with Universities/ Agritech companies/ NGOs/ Public-Private Sectors and Public sector organizations for development and dissemination of research technologies. Following is the detail:

International Level

S. No	Country	Institute/organization	Area
01	Bulgaria	Agriculture Academy of Bulgaria	Scientific Cooperation
02	UK	Fleming Fund	Lab strengthening
03	China	Yunnan Academy of Agriculture Sciences (YAAS)	Infrastructure, Education
04	China	JHU/AF	Animal biotechnology

National Level

S. No.	MoU between PARC &	Area	Duration (Years)
01	M/S Sprout Bio-tech laboratories Karachi	Tissue culture	5
02	M/S PATCO	Agri-Business	5
03	Pro Nature Alliance	Farmers Training	3
04	Women University Sialkot	Student supervision	5
05	Zarai Tarqiati Bank Limited	Agri-business	5
06	ESMA, AJK	Smart irrigation	3
07	Hammad Haasan Progressive Farmer	Smart irrigation	3
08	Royal Cell Biotechnology Pakistan	Embryo Transplant technology	3

09	Mr. Imran Shah farmer	Smart irrigation	3
10	Bank of Punjab	Research funding	5

Human Resource Development

PARC is striving all the time to train their scientists at far with International Level. In this regard, Human Resource Directorate of PARC has facilitated the following number of scientific manpower locally and abroad:

Training	**Program**	**No. of Trainees**
Foreign long term	MS/ M.Phil/Diploma	1
	Ph.D	4
	Post Doc.	1
Local long term	MS/ M.Phil/Diploma	14
	Ph.D	9
Foreign short term		37
Visits		7
Local short term		44

MOUs/Agreements signed during 2021-2023

A) International MOUs/ Agreements = 05

S.No	**Title**	**Signing Date**
1.	MoU between on scientific and Technical Cooperation in the field of Agricultural Research Between PARC and Agricultural Academy of **Bulgaria**	2022
2.	Plant wise, plus work and funding contract PARC &**CABI (UK)**	06-09-2022
3.	Agreement between PARC and **CABI (UK)**: Plant Wise Plus and Funding Contract	06-209-2022
4.	MoU between PARC and Yunnan Academy of Agricultural Sciences (YAAS) Yunnan Province **China**	17-06-2022

5.	LOI between PARC and Institute for Systems Biology of Jianghan University, Wuhan Qingfa Hesheng Seed Company (JHU/AF), **China**	Dec. 2022

B) National MOUs/ Agreements = 11

S.No	Title	Signing Date
1.	MOU between PARC & Sprout Biotech Laboratories (SBL) Karachi	22-07-2022
2.	LOI between PARC & PATCO	30-06-2022
3.	MOU between PARC & Pro Nature Alliance (PNA).	21-08-2022
4.	MOU between PARC & (ACTED) Pakistan.	23-08-2022
5.	MOU between PARC & Government College Women University Sialkot (GCWUS).	21-09-2022
6.	MOU between PARC & Zarai Taraqiati Bank Limited (ZTBL).	11-01-2023
7.	MOU between PARC & Extension Service Management Academy (ESMA) AJK.	11-01-2023
8.	Agreement between PARC & Mr. Hammad Hassan (Farmer).	24-01-2023
9.	LOI between PARC & Royal Cell Biotechnology Pakistan. (RCBP).	03-02-2023
10.	Agreement between PARC & Mr. Imran Shah (Farmer).	13-02-2023
11.	MOU between PARC & the Bank of Punjab (BOP).	23-06-2023

12. PAKISTAN CENTRAL COTTON COMMITTEE (PCCC)

The Pakistan Central Cotton Committee (PCCC), constituted under the Pakistan Cotton Cess Act 1948 in the year 1949, with its headquarters at Karachi (later on shifted at Multan in 2014). Its mandate is to bring about "improvement and development of growing, marketing and manufacture of cotton". The committee is semi-autonomous, with the Federal Minister for National Food Security and Research as its president, and Vice President as its Chief Executive.

The PCCC operates through the following sub-committees.

1. Executive Sub-committee
2. Agricultural Research Sub-committee

3. Technological Research Sub-committee

The sub-committee at No 2 and 3 is headed by a chairman, nominated for term of three years. The executive sub-committee is chaired by the Vice President.

1. MAIN GOAL/PURPOSE OF PCCC

For the purpose of an extensive program of Research & Development (R&D) in all conceivable aspects under the cotton cess act, a chain of Research Institutes/Stations have been set by PCCC all over the country to undertake research into cotton production. The PCCC has developed more than 50 cotton varieties, highest ever from any public sector institution approved for general cultivation. These varieties have excellent fibre quality and successful production fulfilling the needs of both the farmers, ginners and spinners.

2. EXISTING INFRASTRUCTURE

Following are the main directorates of the PCCC.

2.1. PCCC Secretariat at Multan.
2.2. Directorate of Agricultural Research, Multan.
2.3. Directorate of Marketing & Economic Research, Multan.
2.4. Pakistan Institute of Cotton Research & Technology, Karachi.
2.5. Directorate of Cotton Cess Management Lahore.

2.1. PCCC SECRETARIAT

Secretariat of PCCC is headed by the Secretary PCCC that provides the secretarial services to Directorates, Institutes and Stations as per PCCC rules and procedures.PCCC secretariat is responsible for preparation of budgets and its release to the various field offices of PCCC. The secretariat communicates with all the field offices and concerned ministry (MNFS&R). The secretariat consists of the following sections.

- Administration section
- Account section
- Pension section

PCCC has the following overall staff position.

2.1.1. SUMMARY OF STAFF POSITION

S No.	CATEGORY	BPS	SANCTIONED	ACTUAL
1	I	20	7	1
2	II	17-19	156	67
3	III	05-16	386	102
4	IV	01-04	203	69

TOTAL	**752**	**239**

2.1.2. DETAILS OF STAFF POSITION

S. No	NAME OF POST	BPS	SANCTIONED	ACTUAL
CATEGORY-1 (Equivalent to BPS-20)				
1	Secretary PCCC	20	1	0
2	Director Research	20	1	1
3	Director Marketing & Economics	20	1	0
4	Director PICR&T Karachi	20	1	0
5	Director CCRI Multan	20	1	0
6	Director CCRI Sakrand	20	1	0
7	Director DCCM Lahore	20	1	0
TOTAL			**7**	**1**
CATEGORY-2 (Equivalent to BPS-17 to 19)				
1	Principal scientific officer	19	23	1
2	Spinning mastery	18	1	0
3	Deputy Secretary	18	1	0
4	Deputy Director Accounts	18	1	0
5	Deputy Director Research	18	1	0
6	Deputy Director Cess	18	1	0
7	senior research officer	18	6	1
8	senior scientific officer	18	32	9
9	account officer	17	4	0
10	scientific officer	17	55	40
11	research officer	17	5	1
12	private secretary to VP	17	1	0
13	assistant secretary	17	1	1
14	cess recovery officer	17	1	0
15	public relation officer	17	1	0

16	scientific officer (marketing)	17	2	1
17	scientific officer	17	1	1
18	statistical officer	17	1	1
19	administrative officer	17	3	1
20	Librarian	17	2	0
21	Superintendent	17/16	13	9
TOTAL			**156**	**66**
CATERGORY-3 (Equivalent to BPS-5 to 16)				
1	PA to VP	16	1	0
2	Accountant	16	15	1
3	Assistant protocol officer	16	1	0
4	Research assistant	16	9	1
5	Assistant computer programer	16	2	0
6	Assistant private secretary	16	9	3
7	PA to secretary	16	1	0
8	Office Assistant	15/16	31	15
9	IT network assistant	14	2	0
10	Stenotypist	14	9	1
11	economic assistant	14	1	0
12	Statistical assistant	14	2	0
13	Mechanic	13	3	0
14	Testing assistant	13	17	7
15	Storekeeper technical/chemical	10	2	0
16	Lab. Tech. Assistant	11	2	0
17	Cashier	11	1	0
18	Upper division clerk	11	38	13
19	Field assistant	10	41	26
20	Observation assistant	10	2	0
21	Telephone Operator	9	2	0
22	Electrician	9	2	1
23	Fitter	9	2	0

24	Mechanic	9	1	1
25	Fitter cum operator	9	1	0
26	Artist	9	1	0
27	Lower division clerk	9	37	8
28	Fiber tester	8	5	0
29	Store keeper	7	4	1
30	Driver	7	15	8
31	Tractor Driver	7	15	1
32	Computer operator	7	11	0
33	Plumber	7	2	0
34	Dispatch rider	7	1	0
35	Carpenter	7	1	0
36	Line man	7	2	0
37	skilled worker	7	1	1
38	Jobber	7	2	0
39	Head Mali	5	1	0
40	Laboratory attendant	5	41	16
41	Library attendant	5	1	1
42	Gas plant man	5	1	0
43	Insect pin setter	5	2	0
44	Filed assistant	5	46	0
TOTAL			**386**	**105**
CATEGORY-4 (Equivalent to BPS 1 to 4)				
1	Tube well operator	3	5	0
2	Field jamadar	3	2	0
3	Tractor cleaner	3	1	0
4	NaibQasid	1	61	17
5	Chowkidar	1	26	7
6	Cleaner	1	6	4
7	Farash	1	1	0
8	Cook	1	2	1

9	Helper	1	3	1
10	Guest House attendant	1	1	1
11	Beldar	1	67	23
12	Spray man	1	2	2
13	Field man	1	1	0
14	Field worker	1	5	2
15	Greaser	1	1	1
16	Mali	1	1	1
17	Sweeper	1	18	7
TOTAL			**203**	**67**
GRAND TOTAL			**752**	**239**

2.2. DIRECTORATE OF AGRICULTURAL RESEARCH

Directorate of Agricultural Researchof the Pakistan Central Cotton Committee is charged with the task of coordinating and evaluating agricultural research on cotton at national level, deals with overall cotton crop agricultural research policy, planning, implementation, coordination, monitoring and evaluation, reviewing and reporting the progress reports of various activities, programmes and projects of various institutes and stations of PCCC. Directorate of Agricultural Research is also responsible for coordination with other provinces and organizations of federal and provincial governments as well as private sector.

The key responsibilities of the Directorate of Agricultural Research are;

- **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 soil and agro-climatic conditions of different ecological zones under the supervision which entrusted with the task of research on cotton varieties in the country prior to their approval for general cultivation. During the cotton crop year 2022-23, Directorate of Agricultural Research evaluated 89 new cotton strains of various research organizations and private sector companies.
- **National Technology Testing Trials:** New technologies are also tested at PCCC institutes/stations.

- **National Chemical Testing Trials:** Various new candidate chemistries in pesticides are tested and on the basis of testing results these candidate pesticides are registered by Federal Department of Plant protection (DPP).
- **Cotton Travelling Seminars:**The Directorate organizescotton travelling seminar each year with the main objective to assess cotton crop situation and to observe the field trial management of different institutes and stations.
- **Meetings of Agricultural Research Sub Committee (ARSC):**
  TheDirectorate of Agricultural Research organizes each year the meeting of the ARSCwith 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 seven research stations working under the DAR's headquarter based at Multan since November 2016.

2.2.1. COTTON RESEARCH INSTITUTES AND STATIONS

2.2.1.1. Central Cotton Research Institute, Multan.
2.2.1.2. Central Cotton Research Institute, Sakrand.
2.2.1.3. Cotton Research Station, Bahawalpur.
2.2.1.4. Cotton Research Station, Sahiwal.
2.2.1.5. Cotton Research Station, Mirpurkhas.
2.2.1.6. Cotton Research Station, Ghotki
2.2.1.7. Cotton Research Station, D.I.Khan.
2.2.1.8. Cotton Research Station, Sibbi.
2.2.1.9. Cotton Research Station, Lasbella.

These research institutes and stations 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 56 cotton varieties which are given below.

2.2.2. Varieties developed by PCCC from 1985 to 2023 along with their fibre characteristics.

S No.	Variety	Year of 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	-
50	CIM-785	2021	40.0	29.0	4.6	-
51	CYTO-533	2021	41.0	28.1	4.2	-
52	CYTO-535	2021	41.2	28.8	4.1	-
53	CYTO-226	2021	41.0	30.5	4.6	-
54	BH-221	2021	38.0	29.1	4.6	-
55	CIM-343	2022				
56	CIM-537	2022				

2.3. DIRECTORATE OF MARKETING AND ECONOMIC RESEARCH

The directorate of marketing and economic research (DMER) was set up in 1979. It aims at ascertaining the nature of demand of Pakistan cotton, explores the market potential, assess production potential and extend assistance to the authorities in production planning, policy making, execution, and monitoring of various programs of economic nature. The DMER makes assessment of the cotton situation, keeps a watchful eye on ginning operations and movements of cotton during the season and closely follows prices, consumption, exports and stocks. The information and analysis of data and facts facilitates the authorities and policy makers in preparation and execution of cotton production plans. These facts also guide the growers, ginners, cotton exporters and the researchers in their functions towards realization of benefits and rewards of their intensive efforts. The activities have significantly contributed towards highlighting the economic importance of cotton among researchers and guiding them in pursuing right direction of research. The DMER carries out studies on marketing research and cotton development programs relating to production, trade and its utilization.

2.3.1. FUNCTIONS OF DMER

The directorate carries out the studies and investigations of economic and marketing aspects of cotton at fundamental and applied level to bring out the behaviors of economic factors together with suggested remedial measures. The DMER also regularly provides the information data, facts and figures on all aspects of cotton to other divisions of PCCC, ministry of National Food Security & Research, other ministries and concerned departments, research organizations and trade associations. These are also provided to foreign organizations like ICAC, FAO, World Bank, Japan cotton spinners association etc.

For the dissemination of information, it regularly publishes;

- Daily market report
- Weekly update on cotton
- Monthly cotton review
- COTISTICS, Annual cotton statistical bulletin

2.4. PAKISTAN INSTITUTE OF COTTON RESEARCH & TECHNOLOGY, KARACHI

PCCC at its first meeting in March 1949 considered and approved the proposal of setup of PICR&T and its foundation stone was laid out by the then Governor General KhwajaNazimuddin on 26th January 1951. Its opening ceremony was performed by the then Prime Minister, Ch. Muhammad Ali on 22nd March 1956.
PICR&T consisted of six divisions;

- Textile physics division
- X-ray microscopic division
- Textile testing division
- Spinning division
- Textile chemistry division
- Cotton seed chemistry division

2.4.1. Functions of PICR&T

- **Technological Research on cotton and textile technology**

Technological research emphasizes on production and spinning potential of Pakistan cotton on commercial scale,comparative study of the quality characteristics of yarn manufactured by the new spinning system and ring spinning,modern developments in the techniques for production of indigo-dyed blue denim and study of different parameters of Bt. Cotton seed oil.

- **Testing facilities**

The institute provides test house facilities to cotton breeders, textile traders, industry and exporters. The test reports/certificates are issued on the assessment of cotton fibre and textile material testing. For testing we strictly follow international standard like ASTM (American society for testing and materials), BS (British standard), AATCC (American association of textile chemists and colorists). The institute tested thousands of samples so far and provides Technical assistance to Pakistan standard and quality control authority (PS&QCA). The Officers of PICR&T are the members of different textile sectional committee and institute also offered testing facilities for new standards and specifications pertaining to different textile material and test methods.

- **Training Research**

The institute providing training facilities to the students of universities and textile colleges. PICR&T is playing important role in the field of human resource development by imparting training to individuals from the textile industry and private sector.

2.4.2. Contribution of PICR&T

- PICR&T achieved excellence in research; about 200 have been so far published.
- Water proofing of canvas by chemical bounding without adding weight to the fabric (sold to the local tent manufacturing firm).
- Manufacturing of protein from cotton seed.
- A Quick method for determining the maturity of cotton fibre.
- A positive method of determination of mercerization by using X-ray techniques.
- Extraction of edible proteins from cotton seed meal by simple techniques in the laboratory.

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

- NED university of Engineering and Technology, Karachi
- Mehran University of Engineering and Technology, Jamshoro
- Indus Higher Education, Karachi
- Institute of textile and management Karachi
- Department of textile designing Indus valley School of Arts and Architecture Karachi
- Sindh Institute of Textile management Karachi

2.5. DIRECTORATE OF COTTON CESS MANAGEMENT LAHORE

PCCC runs its financial affairs through a fund created under the Cotton Cess Act, 1923. The directorate of cotton cess management was established in 2004. Directorate of cotton cess management has the task of collecting cotton cess from textile/spinning mills which use cotton as raw material for manufacturing yarn. Pakistan Central Cotton Committee uses this cess amount for all its R&D activities.

2.5.1. Cotton Production and Import 2022-23

As per Pakistan economic survey 2022-23 dated 08-06-2023, 4.91 million cotton bales were produced in Pakistan contrary to the production of 8.3 million during 2021-22. So there was 41% reduction of cotton observed in 2022-23. To come up the deficiency of local cotton production by textile/spinning sector of Pakistan,

4.02 million bales were imported. Hence a total of 8.93 million bales of cotton were liable to be cessed @ Rs. 50/bale amounting to Rs. 446.5 million. The Directorate in the year 2022-23 collected the following cess amount.

2.5.2. Total Cotton Cess Collection during 2022-23

S. No.	Month	Arrears recovered	Current Cess Recovered	Total (arrears + current + export)
01	July, 2022	6,090,300	8,022,799	14,335,943
02	August, 2022	12,232,426	9,326,391	22,080,472
03	September, 2022	12,144,553	11,501,514	23,776,184
04	October, 2022	16,672,339	9,231,887	26,440,604
05	November, 2022	15,525,361	8,848,957	24,528,670
06	December, 2022	11,819,492	7,859,834	19,679,326
07	January, 2023	12,604,361	8,261,171	21,019,881
08	February, 2023	10,460,403	9,156,266	19,616,669
09	March, 2023	8,040,137	6,560,746	14,654,333
10	April, 2023	10,633,602	9,688,703	20,376,128
11	May, 2023	11,339,429	9,170,595	20,524,289
12	June, 2023	10,318,053	7,548,118	17,875,501
TOTAL		**137,880,456/-**	**105,176,981/-**	**244,908,000/-**

2.5.3. REASONS FOR DECLINE IN CESS COLLECTION

The directorate collected Rs. 244.90 million cotton cess against 446.5 million which is 54.85% of the recoverable cess amount. Reasons for decline are given below.

2.5.3.1. Court cases (subjudiced)
2.5.3.2. Instigation from APTMA
2.5.3.3. No response from DC due to subjudiced matter
2.5.3.4. Closure of mills due to low cotton production
2.5.3.5. Shortage of power supply

3. CENTRAL COTTON RESEARCH INSTITUTE MULTAN

Central Cotton Research Institute (CCRI), Multan, the prime research facility of Pakistan Central Cotton Committee was established in 1970. By the grace of Allah, the Institute has recently completed 50 years of its establishment in the year 2020. 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 Institute has so far developed 36 elite cotton varieties since its inception. Developments have been made in earliness, heat tolerance, drought tolerance, disease resistance and fibre 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.During the Crop season 2022-23, the CCRI Multan developed two cotton varieties (CIM-343, CIM-537) approved from the Punjab Seed Council.

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

- Asian Development Bank (ADB)
- CERA USA (Biosafety Research in Pakistan Grant Program)
- Common Fund for Commodity (CFC) UK
- Economic Cooperation Organization (ECO)
- Faser Institute (Bremen Fibre Institute), Germany
- Food & Agriculture Organization (FAO) of the United Nations
- International Cotton Advisory Committee (ICAC) USA
- International Cotton Researchers Association (ICRA)
- Japan International Cooperation Agency (JICA)
- Natural Resources Institute UK
- Organization of the Islamic Conference (OIC)
- Overseas Development Agency UK
- South Asian Association for Regional Cooperation (SAARC)
- United Nations Development Program (UNDP)
- University of Hubei, China
- USDA (USAID PL-480, Pak-US ICARDA Cotton Project)
- Fellowships & Trainings
- Borlaug Fellowships
- Chinese Government Trainings

3.1. TRAINING PROGRAMS

CCRI of PCCC Multan organized training programs for Field staff of Agri. Extension and other Departments throughout the cotton crop season in which the CCRI Scientists share their findings for successful cotton production and management.

3.2. INTERNSHIPS AT THE INSTITUTE

The institute is equipped with the latest infrastructure (laboratories, advanced instruments, glaswares/chemicals, farm machinery and experimental area) is an attractive point for the university students to complete their graduate and post-graduate internships. The highly qualified scientific staff provides updated information, guidance and training on different aspects of research disciplines to the internees from various agricultural universities all around the country.

4. CENTRAL COTTON RESERCH INSTITUTE SAKRAND

Central cotton research institute Sakrand was founded in 1976 with the objectives to provide production technology, to solve cotton production problems, to increase cotton production through evolution of high yielding cotton varieties with other required characters. The institute consists of different disciplines like agronomy, plant breeding and genetics, entomology, plant pathology and plant physiology/chemistry sections. The institute has successfully evolved 15 cotton varieties that are cultivated throughout the Sindh province.

The institute continued providing technical expertise to growers of Sindh, especially rice growing areas of Larkana, Jacobabad and Shikarpur districts and also deputed subject specialists to Balochistan for cotton promotion. Technical staff remained in contact with cotton growers of Sindh province and various surveys were carried out throughout the cotton season and advised for timely and proper use of inputs when and where required.

4.1. Meetings

- On 9thFebruary, 2022, Director CCRI-Sakrand attended online annual meeting of the Agriculture Policy Institute Committee on seed cotton 2022-23 crop.
- On 25thMay, 2022, Director CCRI Sakrand on the directives of Dr. Muhammad Ali Talpur, Vice President PCCC conducted meetings with Dr.Fateh Muhammad Marri, Vice Chancellor Sindh Agriculture University, Tandojam and with Dr.Mazharuddin Keerio, Director Cotton Research Institute Tandojam for strengthening the coordination, collaboration and linkages development between the Institutes. Vice Chancellor SAU Tandojam and Director CRI Tandojam assured for strengthening the future coordination.
- On 14th June, 2022, Farmers Cotton Advisory Committee (FCAC) meeting held at CCRISakrand. Mr.Allah Dino Kalhoro, Director CCRI-Sakrand welcomed to the Dr.ZahidMehmood, Director CCRI-Multan and Senior Scientists team of CCRI Multan. Scientists of CCRI Multan and CCRI Sakrand discussed about current problems face by farmers during cotton season and

given recommendations for farmers, which should be implement up to next meeting. All the scientists also visited the experimental farm of CCRI Sakrand.

- On 22th August, 2022, Director CCRI-Sakrand attended online meeting Cotton Crop Assessment Committee 2022-23.
- On 26th January, 2023, Director CCRI-Sakrand attended online annual meeting of the Agriculture Policy Institute Committee on Seed Cotton 202324.
- On 10th February, 2023, Crop Director CCRI-Sakrand attended online meeting on Intervention price of Seed Cotton 2023-24 crop.
- On 14th February, 2023, Process flow for obtaining license for import of genetically modified organisms (GMOs) or their products organized by Pakistan Environmental Protection Agency, Ministry of Climate Change

4.2. Trainings

- On 1st April 2022, Training of BCI Project Staff held at CCRI Sakrand. Mr.AsifMehmood, Program Coordinator, Better Cotton Initiative, Pakistan briefed about the Principles & Criteria for Better Cotton Production. Dr.ZahidMahmood, Project Manager (BCI Project) and Mr. Abdul WahabSoomro, Project Coordinator (Sindh) gave lectures on the subject.
- On 19th April 2022, One Day Training Session was conducted for the Field Staff of BCI Project at District NaushehroFeroze on Importance of Soil Testing and Its Method. Mr.AbdulWahabSoomro, Project Coordinator BCI along with Project Officers were there. 95 Session was conducted by Mr.GhulamSarwarMastoi, Technical Services Officer, Research and Development, Fatima Fertilizer Pvt. Ltd.
- On 9th May 2022, Mr.AbdulWahabSoomro, Scientific Officer/Provincial Project Coordinator BCI conducted One Day Training Session of Project Field Staff of BCI on Cotton Production Technology and revision of Better Cotton Principles and Criteria.
- On 10th May, 2022. Mr. Abdul WahabSoomro, Scientific Officer, Plant Breeding Section CCRI Sakrand, deliver a lecture on Cotton Production Technology with Best Management Practices to the New induced Agriculture Officers of Agriculture Extension Department, Govt. of Sindh at Hyderabad. Organized by Cotton Commission Sindh.
- On 17th May 2022, Training was conducted BCI Project field staff at Moro District NaushehroFeroze. Mr.AbdullahKeerio, SO/Head Plant Physiology Section presented about Soil Health, Fertility and Nutrients Management for Cotton. Mr.AbdulWahabSoomro SO/Provincial Coordinator BCI Project delivered about Cotton Best Management Practices and Insect Pest Management in perspective of BCI principles and criteria. Mr.FaizHussainPanhwar SO/Monitoring Officer was also in training. Mr.Muhammad Roman and Syed Ali Raza Shah Project Officers BCI were also present.

- On 20th May 2022, Training session was organized for capacity building of BCI Project Officers at CCRI, Sakrand. Mr.Meer Muhammad Kolachi, Pest Scouting Officer Agriculture Extension Deaprtment Govt. of Sindh trained about data management, documentation and Record keeping. Mr.AbdulWahab Scientific Officer (Project Coordinator BCI) and Mr.FaizHussain Scientific Officer (Monitoring Officer BCI) also joined session. All PFOs learned information about all documents required to BCI, that will increase working efficiency.
- On 29th May 2022, Training Session was conducted by

  Mr.AbdulWahabSoomro (SO/Project Coordinator) on Cotton Production Technology at project area Qazi Ahmed. Around 50 Lead Farmers attended the session.
- On 1st June 2022, Abdullah Keerio Head Plant Physiology/Chemistry Section delivered the lecture on cotton production technology and briefed about the role of CCRI Sakrand and PCCC in five days training program under "capacity building of field extension staff by providing training and refresher courses" to agriculture officers of agriculture extension at Agriculture Training Institute, Sakrand.
- On 3rd June 2022, in continuation of five days training program under "capacity building of field extension staff by providing training and refresher courses" to agriculture officers of agriculture extension at Agriculture Training Institute, Sakrand, principal ATI Sakrand Muhammad BachalSohu and Senior Instructor Hamid Ali Solangi with Agriculture officers visited experimental farm of CCRI Sakrand. Director CCRI Sakrand Allah Dino

  Kalhoro welcomed the guests. Abdullah Keerio Head Plant Physiology/Chemistry Section and Farhan Ahmad Head Entomology Section delivered the lectures on field evaluation of cotton growth & development stages, nutrient management and pest scouting &eco-friendly management 96 practices for better yield of cotton. Abdul WahabSoomro also briefed about the potentials of CCRI varieties.
- On 3rd June 2022, Abdullah Keerio Head Plant Physiology/Chemistry, Farhan Ahmad Head Entomology, and Abdul WahabSoomro SO Plant Breeding Sections attended as guests in closing ceremony of five days training program under "capacity building of field extension staff by providing training and refresher courses" to agriculture officers of agriculture extension at Agriculture Training Institute, Sakrand. Dr.KarimBuxLeghari Director Wheat Research Institute Sakrand chaired as chief guest.
- On 14th June 2022, Under the BCI project CCRI Sakrand conducted Mega Event for capacity building of Lead Farmers on Cotton Production Technology. Mr.Allah Dino Kalhroro Director CCRI Sakrand welcomed the participants. Dr.ZahidMahmoodDirector/Project Manager BCI CCRI Multan

along with his team Dr.Fiaz Ahmed and Dr.NaveedAfzal discussed on cotton issues and briefed on Cotton Production Technology. Mr.AbdulWahabSoomro SO/Project Coordinator CCRI Sakrand discussed about implementation of project as per BCI principles and criteria.

- On 3rd January, 2022, Abdullah Keerio Head Plant Physiology/Chemistry Section presented a lecture on "Importance of soil and soil testing for better crop production" in Training of Trainers {ToT}. Under a project entitled "Rehabilitation and Rebuilding of Flood Affected Communities" organized by Cotton Connect and Safe Pakistan Sindh.
- On 14 to 16 February, 2022, Pakistan Central Cotton Committee (PCCC) in collaboration with Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) organized training course on "Productivity Enhancement of Cotton by Using Modern Agronomic Practices" under the OIC Cotton Capacity Building Programme (COTTONCAB) for the benefit of National Cotton Institutions in OIC African Member Countries from 14-16 February 2023. The training course was also coordinated by Islamic Development (IsDB), Food & Agriculture Organization (FAO) of the United Nations and African Association. On the second day (February 15, 2023) Abdullah Keerio Scientific Officer/Head Plant Physiology/Chemistry Section delivered the lecture on "Cotton Nutrient Management". 37 participants from African countries including Nigeria, Togo, Uganda, Cote-D'Ivoir, Mozambique, Namibia, and from Pakistan, Turkey & Azerbaijan attended the training program.

4.3. Seminars

- On 12thMarch, 2022. Mr. Abdul WahabSoomro, Scientific Officer, Plant Breeding Section CCRI Sakrand, delivered a lecture on Cotton Production Technology with Best Management Practices at Qazi Ahmed in a ZaraiBethak. Organzied by ZaraiTarqiati Bank Limited.
- On 22ndJune, 2022. Mr. Abdul WahabSoomro, Scientific Officer/Project Coordinator, Plant Breeding Section CCRI Sakrand, deliver a lecture on Cotton Production Technology with Best Management Practices during the Lead Farmers Training in Better Cotton Project at CCRI-Sakrand.
- On 05th July, 2022, Abdullah Keerio, Head Plant Physiology/Chemistry Section and Farhan Ahmad, Head Entomology Section delivered presentations on Clean Cotton and Management of Pink Bollworm & Whitefly in mega seminar organized by Cotton Commissioner Agriculture Extension Sind at ATI Sakrand.
- On 7th October, 2022, World Cotton Day" celebrated at CCRI Sakrand.
- On 20th October, 2022, Director CCRI Sakrand attended as special guest in One day seminar on "Profitable cultivation of wheat" organized by Fatima Fertilizer Company.

5. ACHIEVEMENTS OF PCCC

The PCCC Multan has made tremendous progress in cotton R&D in different aspects of cotton crop. Some of these are mentioned hereby;

- ✦ Hosting world cotton gene pool comprising 6143 entries (Local; 1290 and Exotic; 4853) in medium term (50 years) and long term (100 years) storage facilities, and their characterization for heat, drought and CLCuV tolerance.
- ✦ Developed short duration varieties (210 to 150 days; CIM-506).
- ✦ Developed CLCuV resistant varieties, high lint percentage (34-45%) and staple length (27.0-33.0 mm) varieties.
- ✦ Developed 11 genetic male sterile (GMS) lines at Breeding and Genetics.
- ✦ Maintained living herbarium of 33 species of Gossypium germplasm.
- ✦ Hosting facility for karyotypic analysis of interspecific hybrids (21 hybrids).
- ✦ Established a biotechnology lab with limited resources.
- ✦ Developed 56 varieties (42 Non-Bt and 14 Bt).
- ✦ Developed production technology for different regions and IPM strategies for different pests.
- ✦ Providing fibre testing services at Faser Institute, Germany recognized standards.
- ✦ Providing training to farmers, extension workers, academia and industry.

6. PUBLICATIONS

- ✦ COTISTICS, annual cotton statistical bulletin.
- ✦ Cotton Review, Monthly cotton statistical bulletin. ✦ The Pakistan Cotton (Biannual research journal) ✦ Quality survey of Pakistan Cottons.
- ✦ Annual Summary Progress Reports (Yearly basis)
- ✦ Annual Research Plan (Yearly basis)
- ✦ The Pakistan cotton grower (Quarterly basis)
- ✦ Newsletter (Monthly basis)
- ✦ Booklets (Cotton Production technology)
- ✦ Training guide (need basis)
- ✦ Research papers
- ✦ General articles (newspapers, journals)
- ✦ Variety proposals
- ✦ Brochures (Varieties, production technology, pests and disease management)
- ✦ Cotton update (weekly)
- ✦ Cotton market update (daily)

- ✦ Website of PCCC has been launched and updated on daily basis. All the current publications are being uploaded on regular basis.

13. PAKISTAN COTTON STANDARDS INSTITUTE (PCSI)

1. Introduction:

Pakistan cotton is inherently of good quality. But, absence of quality control measures, improper handling and ginning practices nonexistence of a pricing system based on premium and discounts, non-implementation of recognized grading system leads to depreciation of the value of raw cotton and the resulting textile products and that the country is not getting real intrinsic value of its silver fibre from the international market.

Being cognizant of these problems, the Government decided to introduce standardization of cotton to bring it at par with the internationally accepted standards for improving the competitiveness of Pakistan's cotton as well as ensuring better returns to cotton growers, ginners, spinners, exporters and the national economy. For this purpose Cotton Standardization Ordinance 2002 was promulgated to establish Pakistan Cotton Standards Institute and to promote the quality control of cotton.

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 :

I. 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.

II. Mission:

i. Education/ Awareness Campaigns. ii. Human Resource Development. iii. Proper picking and handling procedures.
iv. Improved ginning practices. v. Minimizing contamination.
vi. Incentive Based Marketing System.

III. 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/ Activities during 2022-2023 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 program conduct 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 .Till date over **2724** personnel have been trained through this program. Recently **31** participants benefited from the training program which was widely acclaimed by the cotton sector. In the light of the directives of PCSI Board of Directors the number of training programs has been increased from three to six.

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 Textile University, 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 2022-23

Targets and the achievements made during the year 2022-23 is 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 2022-23 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.

Cotton Selectors' Training Course:

During 2022-23 one Cotton Selectors Training Course has been organized at PCSI Regional Office, Multan in the month of Aug 2023 which was due to be held in April 2023. Through this course 31 personnel from the public and private sector

have been trained in the skills of cotton classing and grading. Since the introduction of these training courses 2724 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 **1863 samples** have been tested at the Cotton Fiber Testing Laboratories of PCSI during 2022-23.PCSI is planning to upgrade its labs through Funding of PSDP.

(vi) Seed Cotton Grade and Lint Cotton Grade Boxes :

120 boxes of seed cotton grades and 300 Lint cotton standards boxes were prepared for the cotton season 2022-23. The said boxes have been provided to the stakeholders of cotton on demand.

S.No	YEAR	Seed Cotton Boxes	Lint Cotton Boxes
1.	2022-23	120	300

(v) PCSI & KCA Collaborative Training Program:

PCSI arranges Two Calendar week Cotton Grading and Classing Course at Cotton Exchange Building, Karachi in collaboration with KCA every year. This year from 6Th March 2023 to 17th March 2023 Stakeholders across the board, particularly Textile value chain, Exporters, Ginners, Buyers, Brokers from all over the country participated in the course. PCSI technical officers (Cotton Classers) imparted the training. During the course there were practical as well as theoretical classes arranged for the trainees besides a visit each to a textile mill and PCSI Cotton Fiber Testing Lab, Karachi to facilitate the participant for acquiring enhanced knowledge on the spot. **21 participants from public and private sectors attended the Course. In total 181 (47+40+20+28+25+21) participants have attended the course in last Six years.**

(vi) On Farm/ Cotton Ginning Factory Demonstration:

In order to increase proper ginning practices o3 on ginning factory demonstrations and 12 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 :

To improve 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. Advise grade wise heaps of seed cotton and before ginning properly drying the seed cotton, Dandary and Khalary system must be apply.
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: 9,510,082,525/- (Rs: 951.00 millions) is still outstanding. During 2021-22 & 2022-23 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 Bench Multan 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 **2022-23** the Institute generated around **RS.827,750 (Eight hundred twenty seven thousand seven hundred fifty only)** as annual income .

S.NO.	Income generated	Amount in RS.	Total(Rs)
1.	PCSI Head Office, Karachi.		
	Cotton Sample Testing Fee.	278450	
	C S F	Nil	
	Training Course Fee.	Nil	
	Sale of Cotton Standards Boxes	276000	
			554450
2.	PCSI Regional Office, Sukkur.		

	Cotton Sample Testing Fee.	600	
	Training Course Fee.	NIL	
			600
3.	PCSI Regional Office, Multan.		
	Cotton Sample Testing Fee.	242700	
	Training Course Fee.	30000	
			272700
	Grand Total in Rupees.		RS:827750

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:

Pakistan Cotton is inherently of good quality but due to contamination and non-implementation of cotton standardization system the commodity is not fetching its real intrinsic value from the international market. To achieve the same the only methodological approach is the implementation of Cotton Standardization Ordinance 2002 along with the amended cotton control Act, 1966 for the production of high quality clean cotton with letter and spirit across the board. It will have direct impact and immediate bearing on the entire chain of value addition till the final made-ups, thus providing substantial boost to the national exchequer.

10. Future Out-look/Plans:

1. Implementation of amended 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 campaigns in 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. Arrange on Farm /Factory demonstrations / Seminars/ Workshops /Training programs in various cotton producing districts.
8. Organize other activities related with enhancement of cotton quality.

14. 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.

15. 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.411/2019-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 2022-23, two BoD and one Annual General Meetings took place where the directors and the member of general body were apprised of LDDB's operational, financial and development plans.

2. Livestock and Dairy Development Board successfully executed three transformative Livestock Projects under the PSDP Program during the fiscal year 2022-2023, namely:

1. Prime Minister Initiative for Save the Calf

2. Calf feedlot fattening in Pakistan

3. Prime Minister initiative for Backyard Poultry

The diligent execution of these projects has yielded remarkable outcomes, fostered sustainable growth and enhanced our nation's agricultural landscape.

- **Prime Minister's Initiative for Save the Calf:**

Project aimed to rescue vulnerable baby calves from premature mortality and slaughtering. These calves serve as the foundation for subsequent back grounding and feedlot operations, enabling the production of premium-quality

meat for domestic and export markets. The project aimed to achieve a significant reduction in calf mortality from 30% to an impressive 5% nationwide. During the fiscal year 2022-2023, Federal Government has provided 149.59 million rupees for Save the Calf project. The Project successfully nurtured 41,646 baby calves for back grounding and feedlot fattening, achieving 91% of its targets of year 2022-2023. Over four years, the cumulative number of saved calves reached an impressive 201,286. Financial support of Rs. 6,500 per calf and immunization was extended to 106,593 livestock farmers during the project period. Additionally, 69,413 farmers received comprehensive training on husbandry practices and calf rearing business models. To enhance market access, an innovative online marketing web portal was developed, connecting farmers with market agents.

- **Calf Feedlot Fattening in Pakistan**:

  Project aimed to produce high-quality meat for local consumption and export. By incentivizing the farming community and promoting the adoption of advanced production and health technologies, this initiative aimed to vertically expand our national meat production. 85.145 million rupees were provided to project in the 2022-23. Notably, 39,983 male buffalo/cow calves and 70,000 kids/lambs were successfully fattened during the fiscal year 2022-23, achieving 84% of the target. Over four years, the project impressively fattened 235,667 male buffalo/cow calves and 310,000 kids/lambs, significantly contributing to our meat production objectives. Moreover, 47,102 farmers associated with the project received on-site training, enhancing their expertise in husbandry practices and advanced meat farming.

- **Prime Minister Initiative for Backyard Poultry**

  Project focused on empowering backyard poultry flocks to enhance poultry meat and egg productivity in the country. Through providing highproducing birds at a 30% subsidy, this project addressed protein deficiencies and malnutrition. 35.942 million rupees are released by the federal government for Backyard Poultry program in year 2022-23. Project achieved 55% of its targets, with the distribution of 224,964 birds in the fiscal year 2022-23, the cumulative progress over four years has been remarkable. A total of 3,302,804 birds have been distributed, excluding Sindh, (84% of the total target) and advancements have been made in the hatchery component in AJK and GB regions. Upon successful completion of these projects on 30th June, 2023 it is anticipated that these three projects have confidently assert a significant impact on the livestock and dairy sector in Pakistan.

16. FISHERIES DEVELOPMENT BOARD

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 (22-23)

1. Pilot Project for Development of Shrimp Farming Cluster

1. **Project Cost:** 6381.86
2. M(Federal Component1350.33M)
3. **Gestation Period:** 5 years
4. **Project Areas:** Punjab, Sind & Baluchistan
5. **Expenditure 22-23:** 140.8 M

Federal Component

1. Recruitment of Project staff for PIU established.
2. Model Shrimp Farm, Civil work in progress. Earthen pond construction is completed.
3. Land of Shrimp Hatchery Acquired at Daam Balochistan. MoU with Balochistan Fisheries Department signed. Funds transferred to Pak-PWD and the shrimp hatchery site handover to Pak PWD. Civil work in progress. Road, boundary wall construction is in progress.
4. 5 workshops have been conducted in Karachi and Lahore on the "promotion of shrimp farming and export development in Pakistan".
5. Training manual prepared, printed and distributed in the farmers.
6. The 293 Farmers and 25 extension workers have been trained in shrimp farming
7. National Residue Control Plan (NRCP) has been prepared and shared with relevant ministry (maritime affairs) for implementation.

Punjab Component

1. Civil work for the construction of Saline Water Aquaculture Research Center is 80% completed in Muzaffargarh.
2. Civil work completed for up gradation of the training center and hostels at Rawalpindi and Bahawalpur.
3. PC1 revision in process for some changing in scope and cost escalating.

Targets for Forthcoming Fiscal Year 2023-24

1. 80 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
3. Civil work of Model Shrimp Farm will be completed at Pind Dadan Khan District Jhelum and 100% civil work will be completed, subject to the availability of funds.
4. A Saline water Aquaculture Research Center will be completed and become functional during current fiscal year

Pictorial View of Project:

Civil Work of Shrimp Hatchery in Damb Balochistan

Civil Work of Model Shrimp Farm at PD Khan, District Jhelum Punjab

2. Cage Culture Cluster Development Project

1. **Project Cost:** 4965.50M(Federal Component680.09M)
2. **Gestation Period:** 5 years
3. **Project Areas:** Punjab, Sind & Baluchistan
4. **Expenditure 22-23:** 73.8 M

Achievements Federal Component

1. PMU established
2. Establishment of three model cage farms completed.
3. Demonstration of Cage Fish Farming practices to the farmers.
4. 50 Master Trainers trained.
5. 655 fish farmers, fish farm workers and stockholders have been trained.

Punjab Component

1. PIU established
2. Subsidy for 1230 cage units, completed.
3. Civil Work of three (03) Fish Health Labs in Punjab completed at Multan, Gujranwala, and Sargodha.
4. Fish extension services in place.

Targets for Forthcoming Fiscal Year 2023-24 Federal Component

1. PMU in operation

2. Demonstration of cage fish farming practices to the farmers.
3. 545 farmers will be trained
4. Conference/Seminar of Cage Fish Farming
5. Monitoring of PIU, Punjab

Punjab Component:

1. PIU in operation
2. Tender for installation of 1000 cage units on subsidy in public waters of Punjab.
3. Award of tender to lowest bidder through an open competitive bidding procedure.
4. Applications invited from potential cage fish farmers for the provision of subsidy.
5. Selection of successful farmers through open balloting.
6. 1000 cages installed on selected water bodies all over the Punjab.
7. Provision of extension services to cage fish farmers throughout the Punjab.

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 PakistanFY 2022-23

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:

1. 15 Days Training program was conducted on 14th Nov 2022 to 28th Nov 2022 on the Topic **"Intensive Trout Farming and Modern Seed Production Technologies"** at, GB. Two Russian experts were speakers. The total No. of participants were 41 from three different localities of Pakistan i.e., KP, GB, AJ&K, and Punjab.
2. Civil work for the establishment of 02 New Trout Hatcheries, New trout hatcheries at Ghanche and Niaslo are completed and functional.
3. Establishment of 02 No. Cold Storage Centers in Sakardu and Gilgit are completed and procurement of equipment is in progress.
4. The establishment of a directorate office has been initiated in GB and 80% of the civil work is completed.
5. Capacity Building program under PSDP project, Multiple training sessions have been conducted in GB, in which 500 private farmers and 150 government officials have participated and trained about farming, marketing, and other fish production strategies. Likewise in AJ&K, 306 individuals (farmers/ officials) have been trained.
6. Establishment of the Research and Training Center, Madian, Swat, had been started, and 66% of civil work is completed.
7. Establishment of a New Hatchery at Siran Valley, Mansehra, KPK. 80% of civil work is completed.
8. Rehabilitation & Repair work of hatcheries, renovation of (06Nos) hatcheries in GB is completed, while Guru Juglote hatchery rehabilitation

is in progress. 7 existing hatcheries are under renovation in KPK. The existing 6 hatcheries in AJ&K are 85% renovated.

9. Establishment of New Trout Farms, 125 private trout farms are fully established and functional while the civil work for the rest of the 64 is in progress, in Malakand and Hazara division, KPK. 12 trout farms are fully developed while the construction work of 5 trout farms is in progress, in Nelum Valley, AJ&K.
10. Establishment of warm water fish ponds, 20 warm water farms were initiated to develop in all districts of AJK. So far 15 farms are fully developed while civil work for the remaining is in progress.
11. One new hatchery at Jehlum Valley is also under construction.

Targets for Forthcoming Fiscal Year 2023-24

1. Construction of trout hatchery in Siran Valley, Mansehra will be completed.
2. 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 will be completed.
3. Construction of Cold-Water fisheries, Research, and Training Center in KPK will be completed.
4. Training of 134 Nos. officials and private farmers will be conducted in GB.
5. Establishment of the Directorate office will be completed while the construction of a Research Center and Product Development Center will be initiated in Gilgit.
6. Rehabilitation of Chikkar fish hatchery and repair work of other hatcheries in GB will be completed.
7. Establishment of a trout hatchery in AJ&K will be completed.
8. Procurement of equipment for cold storage centers 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 Niaslo Shigar & supervisor office

Capacity building & Training activities

Distribution Of Fish Feed And PPE.S To Private Farmers In District Gilgit

17. PAKISTAN TOBACCO BOARD

Over view

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.

18. 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)

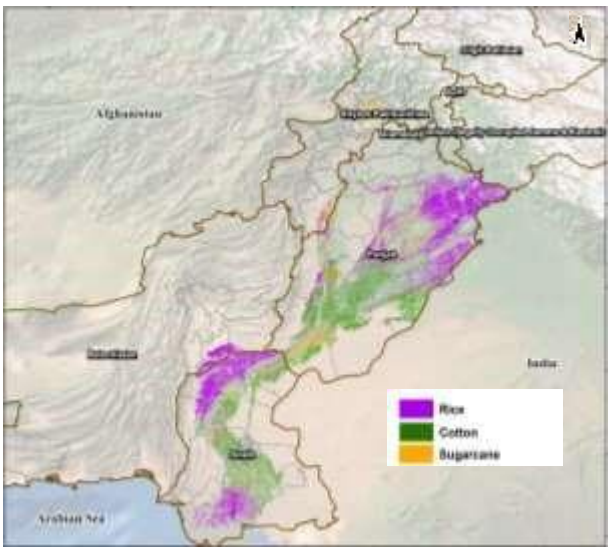
SUPARCO Sugarcane Crop Estimates: 2022-23			
Province	Area	Yield	Production
	000 ha	Tons/ha	000 Tons
Punjab	828.3	68.7	56928.7
Sindh	295.0	60.5	17848.3
Khyber Pakhtunkhwa	103.1	57.3	5904.8
Pakistan	**1226.4**	**65.8**	**80681.7**

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) Assessment of Damage due to Rains/Hailstorms (March, 2023)

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

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SUPARCO

INSIDE THIS ISSUE

SUPARCO, the National Space Agency of Pakistan, started the program on "Monitoring of Crops through Satellite Technology" during the year 2005. This is a perpetual study encompassing all growing seasons around the year. The purpose of this initiative is to reinforce support for policy makers, planners and private sector for food security, stocking, marketing, trade and industrial management. The final crop estimates are released by end of March for Rabi crops and mid of October for Kharif crops.

Food and Agriculture Organization of United Nations, (FAO-UN) provided technical backstopping for analytics and transfer of technology.

Wheat, cotton, rice, sugarcane, maize and potato crops are being covered under this program. In addition, large scale geospatial applications of satellite remote sensing technology have been made for monitoring/mitigation of natural disasters (floods, flash floods, and drought) and providing reconnaissance detailed information ordained for the uplift of agriculture and allied pursuits.

CROP SITUATION: JUNE 2023

Summary

By the end of June 2023, the Satellite based Normalized Difference vegetation Index (NDVI) values shows 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 Kashmir & 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 2787.0 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 3089.90 thousand hectares with an average yield of 2945.9 Kg per ha. Sugarcane production target of 78.588 million tons is fixed from an area of 1181.90 thousand hectares with an average yield of 66.48 tons per hectare.

Cotton crop sowing has been completed during the month in Punjab and Sindh and is at varying 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 6.5 percent compared to June 2022. Approximate average ex-gin price during June 2023 was Rs. 20906.4 per 40 kg against Rs. 22366.7 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. Activities to be undertaken in the fiscal year 2023-24

The project has been closed by 30th June, 2023.