

NIFA

Annual Research Program Evaluation & Planning Document 2024

NIF-X-RCD-06-026

Nuclear Institute for Food & Agriculture (NIFA)

Tarnab, Peshawar, Pakistan

www.nifa.org.pk

Pakistan Atomic Energy Commission

ISO 9001: 2015 Certified

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FOOD & NUTRITION DIVISION (FND)

FND 1: FOOD ENGINEERING AND IRRADIATION GROUP

FND-1-1

1. Project Title: Development of Hybrid Indirect Type Solar Dryer for Drying of Fruits and Vegetables
2. Funding Source Type: PAEC & ALP
3. Principal Investigator: Dr. Maazullah Khan, DCE
4. Team Members (Scientists & Staff): Dr. Zahid Mehmood PS, Mr. Alamgeer Khan PS, Muhammad Zubair Shah PE, Mr. Muhammad Asim Irshad JS, Mr. Waseem Jan ATO, Mr. Daulat Khan PSA, Mr. Amjad Abbas, Mr. Muhammad Bilal
5. Project Objectives:
 - i. Study solar drying of onion, bitter gourd, persimmon, banana and dates, and their storage stability.
 - ii. To enable farmers/entrepreneurs reduce postharvest losses and increase their income through environment friendly renewable solar energy
6. Background and Justification:

Utilizing alternate, renewable, and clean energy sources in food processing and drying can significantly reduce energy costs and environmental impact. Solar energy is widely available during the day, is a key resource for this purpose. Drying requires specific conditions ie 60-70°C temperature, below 50% humidity, and sustained airflow. The present solar system has been designed to utilize solar energy for water and air circulation as well heating the chamber through solar cells. Heating of the chamber and storage water is also achieved indirectly through solar radiation by using the principles of black body heat absorption.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. A solar dryer consisting of drying chamber with capacity of 100 kg fresh fruits/vegetables has been fabricated on the roof of NIFA workshop.
 - ii. Maximum temperature achieved in the drying chamber was 70oC. In preliminary drying experiments, honey dew melon (cantaloupe) was dried from 93% to 7% moisture content in 3 days while bitter gourd was dried from 77.8% to 7 % moisture content 2 days.
 - iii. Organized a one-day training workshop on “Solar Drying of Fruits and Vegetables” on June 4, 2024, at NIFA, Peshawar.
 - b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil
8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	1,680,200
2.	Total laborer charges (both from project & NIFA)	180,000/-
3.	Total POL charges	-

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Development of hybrid indirect type solar dryer for drying of fruits and vegetables.	Rs.3.21 M	2022-2025

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Solar Drying of bitter gourd (Jul- Sep, 2024)
- ii. Solar Drying of Persimmon fruit (Sep-Nov, 2024)
- iii. Solar drying of dates (Nov-Dec, 2024)
- iv. Reports preparation a submission to ALP (Jan, 2025)
- v. Solar drying of Onions (Feb-March, 2025)
- vi. Solar drying of Bananas (Apr-Jun, 2025)

b. Experimental material of the Project:

Hybrid solar dryer, Bitter gourd, persimmon, onions, dates, banana fruits, analytical reagents.

c. Expected tangible of the project:

Shelf stable, dried Bitter gourd product, persimmon, dates and onions

FND-1-2

1. Project Title: Adaptation of Low Energy Machine Generated Radiation Sources for Surface Decontamination and Disinfestation of Food in Pakistan
2. Funding Source Type: PAEC & IAEA
3. Principal Investigator: Mr. Alamgeer Khan, PS
4. Team members (Scientists & Staff): Dr. Maazullah Khan, DCE, Mr. M. Asim Irshad, JS, Mr. M. Waseem Jan, ATO, Mr. Daulat Khan, PSA & Mr. Luqman Shah, Tech-III
5. Project Objectives: (1-2 points in 2-4 lines):
 - i. Adaptation of low energy X-rays beams from machine sources for food irradiation.
 - ii. Optimization of low energy X-rays irradiation process parameters for shelf-life extension of dry fruits.

6. Background and Justification:

Low Energy Electron Beam (LEEB) technology is now commercially available for the sterilization of medical devices and aseptic food packaging. Additionally, low-energy X-ray units are being optimized for the treatment of spices and dry fruits. As Pakistan exports dry fruits primarily to Gulf countries, radiation processing plays a crucial role in maintaining quality and meeting quarantine standards for food and agricultural products.

7. Summary of last year research Work:

- a. An irradiation dose of 5 kGy demonstrated the best results in terms of overall acceptability, including mycotoxin decontamination and physicochemical and sensory evaluation, for shelled peanuts stored at ambient temperature for seven months.
- b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	130,000
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-

9. Income Generation (Rs)

Activity	Total sale	*Expenditure	Profit
Gemstone irradiation	1.39 Million	-	1.39 Million

*It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24

Project title	Total budget (Rs.)	Duration
Adaptation of Low Energy Machine Generated Radiation Sources for Surface Decontamination and Disinfestation of Food in Pakistan (24289)	9.17 Million	2021-26

11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory:
 - i. Hybrid Solar Drying of Peach fruit (Jul-Sept, 2024)
 - ii. Irradiation, Sensory, Nutritional, Physiochemical Analysis and Microbial Quality Parameters (Oct, 2024, May, 2025)
 - iii. Data Analysis and Submission of Annual Progress Report to Funding Agency (May-Jun, 2025)
- b. Experimental material of the Project:

Peach fruit, packing material, solar dryer, Gamma radiation source, low energy X-rays analytical reagents, reference standards.

c. Expected tangible of the project:

Optimized irradiation doses for dried peach fruit

FND-1-3

1. Project Title: Development of Gluten and Preservative-Free Functional Muffins and its Shelf Life Extension of through Gamma Irradiation
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Muhammad Asim Irshad, JS
4. Team members (Scientists & Staff): NA
5. Project Objectives: To develop gluten-free, preservative-free functional muffins by incorporating flax seed and cinnamon, utilizing irradiation technology.

6. Background and Justification:

The demand for gluten-free and preservative-free baked items has risen due to increasing health consciousness and dietary restrictions. Utilizing flax seed and cinnamon not only enhances the nutritional profile but also adds functional benefits such as improved digestion and anti-inflammatory properties. Employing irradiation ensures the muffins are safe for consumption by effectively eliminating microbial contamination without compromising quality, thereby extending shelf life naturally

7. Summary of last year research Work:

- a. Tangible research work findings during 2023-24: 4 kGy dose of irradiation was optimized for the development of preservative-free cakes, effectively extending their short-term storage (21 days) without developing any undesirable odor
- b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	30000
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-

9. Income Generation (Rs)

Activity	Total sale	*Expenditure	Profit
Sale and Production of Food Products	1,003,310	607,777	395,533

*It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory:
 - i. Optimization of Gluten-Free Muffin (Jul-Sept, 2024)
 - ii. Optimization of Functional Muffin adding flax seed and cinnamon powder (Sep-Nov, 2024)
 - iii. Optimization of Irradiation Dose for shelf stability at room temperature (Dec, 2024-Jan, 2025)
 - iv. Physicochemical Analysis and Storage Study (Jan-Apr, 2025)
 - v. Data Compilation and Analysis (May-Jun, 2025)
- b. Experimental material of the Project:

Raw Materials, Equipment, Chemical Reagents
- c. Expected tangible of the project:

Optimized gluten-free, preservative free functional muffin

FND-1-4

1. Project Title: Value Addition of Garlic through Solar Drying:
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Muhammad Waseem Jan, ATO
4. Team members: NA
5. Project Objectives: To minimize Post-Harvest losses and enhance shelf life of garlic by producing garlic powder
6. Background and Justification:

Garlic can be processed into value-added products like powder, paste, and oil, extending its shelf life and marketability. This generates higher income for farmers and reduces post-harvest losses by preserving garlic through drying. Dried garlic products such as flakes and powder are easier to store and transport. These products have strong demand in food, pharmaceutical, and cosmetic markets. Expanding garlic processing reduces import reliance and boosts local economic opportunities.
7. Summary of last year research Work: NA
 - a. Tangible research work findings during 2023-24: NA
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year experiment: NA
9. Income Generation (Rs): NIL
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:

- i. Procurement of raw materials (July-Sep, 2024)
 - ii. Preparation of garlic powder through solar drying (Oct-Dec 2024)
 - iii. Physicochemical Analysis and Storage Study (Jan-Apr, 2025)
 - iv. Data Compilation and Analysis (May-Jun, 2025)
- b. Experimental material of the Project:
Garlic cloves, Chemical Reagents, solar dryer
- c. Expected tangible of the project:
High quality garlic powder with extended shelf life

FND-2: FOOD AND ENVIRONMENTAL SAFETY GROUP

FND-2-1

1. Project Title: Pearl Oyster Yield Enhancement and Commercialization, and Pharmacological Evaluation of Ganoderma Mushroom
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Muhammad Ibrahim, PS
4. Team members (Scientists & Staff): Mr. Khurshid Ahmad, SS, Mr. Nisar Khan ARO, Arshad Ali, ARO, Mr. Masood Khattak Forman, Mr. Mushtaq Khan SA-I, Mr. Muhammad Naveed SA-III, & Dr. Gowhar Ali, (Assistant Professor Department of Pharmacy, University of Peshawar)
5. Project Objectives: (1-2 points in 2-4 lines):
 - i. Enhancement of biological efficiency, spawn-run efficiency and commercialization of Pearl Oyster mushroom through awareness, spawn availability and training
 - ii. Pharmacological profiling and safety evaluation of *Ganoderma lucidum* mushroom
6. Background and Justification:

Edible mushroom cultivation is very useful business as well as provide quality protein and popular medicine. In developing countries, like Pakistan mushroom cultivation can play important role in poverty alleviation as it impacted in China through public awareness, motivation and training.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Pearl Oyster yielded best with compost dimension of 12x17" as improved cultivation technology having 52.9 % biological efficiency (BE).
 - ii. Training Workshop on Improved Oyster cultivation technology to 70 growers from 8 districts of KP
 - iii. Three Oyster species (Pearl, Grey and Pink) were analyzed for phytochemicals: Pear Oyster possessed highest % protein (18.1%) on dry basis. Pink Oyster had the lowest fat (1.37%), while highest % fiber (18.8%) was recorded in Grey oyster. Highest Na (16.4ppm) was recorded in Pearl Oyster while highest Potassium (98.2ppm) was recorded in Pink Oyster.
 - iv. Ganoderma extract exhibited anti-diabetic property through testing on Streptozotocin-induced diabetic rats.
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24:

Food Microbiology Lab was 17025-2017 Accredited by Pakistan National Accreditation Council (PNAC), Islamabad on September 11, 2023.

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	25,000/-
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-

9. Income Generation (Rs) 61,400/-

Activity	Total sale	*Expenditure	Profit
i.Oyster Mushroom Spawn	47 Kg	11750	35250
ii.Oyster Fruit	36Kg	3600	10800

*It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24 NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Oyster mushroom yield enhancement through addition of low-cost ingredients in compost (July to Dec. 2024)
- ii. Quality Oyster Spawn production for easy availability to farmers on demand (July. 2024-June, 2025)
- iii. Ganoderma mushroom will be cultivated (Oct-Dec. 2024)
- iv. Pharmacological Evaluation of Ganoderma (Oct. 2024 – June, 2025)

b. Experimental material of the Project:

- i. Hardwood saw-dust, wheat bran, cotton seed cake, supplementation of compost,
- ii. Grain spawn will be produced on Sorghum Grains/Wheat Straw, etc.
- iii. Experiments will be conducted at the Department of Pharmacy, University of Peshawar

c. Expected tangible of the project:

- i. Biological efficiency of compost/substrate will be improved.
- ii. Oyster Spawn will be commercially developed for sale.
- iii. Pharmacological data of Ganoderma will be available

FND-2-2

1. Project Title: Establishment of a Standardized HPLC Method for Comprehensive Sugar Profiling of Honey
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Khurshid Ahmad, SS

4. Team members (Scientists & Staff) only by Group Leader: NA

5. Project Objectives: (1-2 points in 2-4 lines):

To develop and validate a robust HPLC method for accurate determination of sugar profiles in honey samples

6. Background and Justification:

Peshawar is considered to be a leading honey export hub in Pakistan. However, the absence of a local quality testing laboratory hinders market access. Establishing a honey testing facility at NIFA and developing robust analytical methods, such as HPLC for sugar profile analysis, will enhance quality control and enable local honey producers to meet global standards, boosting exports.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

Analytical methods were optimized for the determination of key honey quality parameters, including HMF, flavonoids, pH, reducing sugar content, and acidity.

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	18000/-
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-

9. Income Generation (Rs):

Activity	Total sale	*Expenditure	Profit
Analytical services	155850/-	77925/-	77925/-

*It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24 NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Collection of honey samples from various sources. Preparation of initial sample solutions for preliminary testing. HPLC Instrument Installation. July – Oct, 2024
- ii. Method Development. Selection of suitable eluents composition. Optimization of flow rate and temperature. Development of calibration curves with standard solutions. Oct, 2024 – Mar, 2025
- iii. Conduction of accuracy and precision tests and repeatability and reproducibility studies. Validation of linearity of calibration curves. Determination of the LOD and LOQ for each sugar. Data Analysis. Report writing and presentation summarizing the project findings. Jan- Jun, 2025

b. Experimental material of the Project:

Honey samples, HPLC instrument, sugar standards, organic solvents

c. Expected tangible of the project:

Development of a standardized HPLC method for accurate honey sugar profiling

FND-2-3

1. Project Title: Development of method for Determination of SO₂ Concentration in Preserved Foods.

2. Funding Source Type: PAEC

3. Principal Investigator: Mr. Muhammad Nisar, ARO

4. Team members (Scientists & Staff) only by Group Leader: NA

5. Project Objectives: (1-2 points in 2-4 lines):

To determine the concentration of SO₂ in preserved food items/products.

6. Background and Justification:

Sulfur-containing compounds like sulfur dioxide and sulfites serve as common preservatives and antioxidants in food and drinks. Excessive sulfite exposure can trigger allergic reactions, breathing difficulties, and other health issues. Developing a titration method for sulfur dioxide determination is valuable for NIFA and food testing labs, offering income opportunities while ensuring safety. In previous ARP instrument was designed and tested on few samples. However, the slightly high STD and RSTD need some more focus on designed.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24 An indigenous apparatus for the determination of sulfur dioxide in preserved foods was successfully designed and tested on commercial samples.

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	10,000/-
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-

9. Income Generation (Rs): Nil

10. Detail of ongoing funded research project (s) as PI only during 2023-24 NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

i. Redesigning of Rankin Apparatus. Jul- Dec, 2024

ii. Validation on standard sample of known concentration of SO₂. Jan-March, 2025

- iii. Analysis of commercial samples & application of statistical tools to get maximum accuracy, repeatability, precession etc. Apr- Jul, 2025
- b. Experimental material of the Project:
Samples of preserved food, glassware.
- c. Expected tangible outcome of the project:
Optimization of titration method for sulfur dioxide determination in preserved food.

FND-2-4

1. Project Title: Anti-microbial Activities of Various Honey Types:
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Arshad Ali, ARO
4. Team members (Scientists & Staff) only by Group Leader: NA
5. Project Objectives: (1-2 points in 2-4 lines):
To optimize method for determination of anti-microbial activities of various honey types
6. Background and Justification:
Honey, a vital food product with useful applications in the various fields especially medicine. It is a complex mixture consisting of water, sugars, flavonoids, various elements, and numerous bioactive compounds. Peshawar stands as the central hub of the honey market, and the establishment of an analytical facility is expected to draw numerous individuals seeking quality analysis for their honey samples.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
Method for Metals (Ca, Na, K etc.), phenol, density, proteins and ash were optimized.
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year experiment

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	14800/-
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	-
9. Income Generation (Rs): NA
10. Detail of ongoing funded research project (s) as PI only during 2023-24. NIL
12. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:

- i. Sample collection. Jul-Sep, 2024
 - ii. Literature review and collection of bacterial stain. Oct-Dec, 2024
 - iii. Testing of honey samples against bacteria. Jan-Aug, 2025
- b. Experimental material of the Project:
Honey samples, bacterial stains, media for microbial growth
- c. Expected tangible of the project:
Development of honey testing facility.

FND-3: FOOD NUTRITION GROUP**FND-3-1**

1. Project Title: Development of an Indigenous Technology for Rapid Testing of Added Micro-Nutrients in Foods
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Zahid Mehmood, PS
4. Team members (Scientists & Staff): Tauqeer Ahmed, JS, Aurangzeb Khan, ARO, Asif Murad, PE, Mr. Khurshid Ahmed, SS, Mr. Shamshad Ali, PSA, Ms. Umme Kalsoom, SA-I & Mr. Haider Ali, Mali-I
5. Project Objectives: (1-2 points in 2-4 lines):

Development of technology for on-spot testing of added micro-nutrients in foods samples

6. Background and Justification:

NIFA has developed spot test kits for the qualitative testing of Vitamin A, iron, and iodine. To enhance the existing Vitamin A kits, a digital Vitamin A Meter (VITA-Meter) will be developed for the semi-quantitative determination of added Vitamin A. This will be an indigenous joint venture between NIFA, Peshawar, and ICCC. Additionally, a storage study will be conducted to assess the stability of the iodine kit for sea salt under various conditions.

7. Summary of last year research Work:

- a. Tangible research work findings during 2023-24:

Storage of Iodine rapid test kit was optimized for one year at room and refrigerated temperature

- b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	10,000
2.	Total laborer charges (both from project & NIFA)	--
3.	Total POL charges	--

9. Income Generation (Rs)

Activity	Total sale	*Expenditure	Profit
Sale of RTKs	15.577	5.05713	10.51987 M

*It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24: Nil

11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory:
 - i. Design and development of prototype of VITA Meter (Jul- Dec, 2024)
 - ii. Optimization of reagents for VITA-Meter for Vitamin-A quantification (Jan-March, 2025)
 - iii. Testing of device for different fortified oil samples (April– June, 2025)
 - iv. R & D on NIFA Vitamin A RTKs for soybean oil (Jul- Dec, 2024)
 - v. R&D on validation of iodine RTK for sea salt (Jul- Dec, 2024)
- b. Experimental material of the Project:
 - i. Analytical reagents, cooking oils of different brands, spectrophotometer, pH meter
 - ii. Different cooking oil brands, fortificants, glass bottles
 - iii. Sea salt, analytical reagents, pH meter
- c. Expected tangible of the project:
 - i. Optimized reagents for VITA-Meter and validation of VITA-Meter
 - ii. Validated RTK for soybean oil
 - iii. Improved RTK for sea salt

FND-3-2

1. Project Title: Development of Rapid Test Kit for On-Spot Detection of Added Zinc (Zn) in Fortified Wheat Flour
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Tauqeer Ahmad, JS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives: (1-2 points in 2-4 lines):
To develop, optimize, and validate a rapid testing kit for qualitative analysis of added Zinc (Zn) in fortified wheat flour
6. Background and Justification:
Zinc (Zn) is an essential mineral found in living organisms, with three major biological roles; as catalyst, structural and regulatory ion. Its deficiency can induce oxidative damage, alterations in immune system, neuropsychological impairment and dermatitis. To curb its deficiency (18.6% in Pakistan) among marginalized and susceptible population, food fortification strategy has emerged as an effective tool.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-2024
Based on the final results; Reagent-1 (R-1), Reagent-2 (R-2), Reagent-3 (R-3) used during experimentations are not recommended for the development of

subject RTK due to inhibitory/masking effects caused by certain interfering/masking agents

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	5,000
2.	Total laborer charges (both from project & NIFA)	
3.	Total POL charges	

9. Income Generation (Rs): (Only by Group Leader): NA

10. Detail of ongoing funded research project (s) as PI only during 2023-24: Nil

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. To explore & investigate the feasibility and efficacy of other reagents for kit development (July - Sep. 2024)
- ii. To conduct R & D on the optimization of screened reagents (Oct. - Dec. 2024)
- iii. R & D on the development & validation of test kit prototype (Jan. - March 2025)
- iv. Storage stability study of test kit (April - June 2025)

b. Experimental material of the Project:

Analytical grade chemicals, variety of flour samples, packaging materials e.g. bottles with tips & caps, packaging boxes etc.

c. Expected tangible of the project:

Development of RTK for on-spot detection of added zinc in fortified wheat flour

FND-3-3

1. Project Title: Method Optimization for Lab-Scale Production of Potassium Iodate (KIO₃)

2. Funding Source Type: PAEC

3. Principal Investigator: Mr. Aurang Zeb Khan, ARO

4. Team members (Scientists & Staff) only by Group Leaders: N.A

5. Project Objectives: (1-2 points in 2-4 lines):

- i. To study & optimize the method for lab-scale production of Potassium Iodate (KIO₃) to achieve maximum yield, purity and cost-effectiveness
- ii. To Evaluate the influence of reaction parameters (temperature, reaction time, concentration etc.) on the yield of Potassium Iodate during the synthesis process

6. Background and Justification: (3-5 lines):

The level of household consumption of iodized salt in Pakistan surpasses 70%. Potassium iodate is the primary fortificant used by the salt processing industry. However, due to import restrictions and escalating prices, there is a pressing need

for a sustainable domestic solution. In response to this critical issue, Nutrition International (NI), has approached NIFA to undertake research and development on the indigenous production of Potassium iodate.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

Optimum molar concentration (4M) for maximum yield (49%), optimum crystallization temperature (50C) for maximum yield (51.14%) and optimum reaction time (25 min.) for maximum yield (58.46%) were achieved

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

8. Expenditure on last year experiment:

S#	Purpose	Rs.
1.	Total consumable charges (no need for detail)	5,000
2.	Total laborer charges (both from project & NIFA)	
3.	Total POL charges (Rs.31430/-calculated by farm branch per acre)	

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24: Nil

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. To study the effects of reaction kinematics on the yield and purity of Potassium Iodate (July. - Dec. 2024)
- ii. To optimize the yield and absolute purity of potassium iodate by varying the reaction parameters (Jan. - March 2025)
- iii. To determine the retention time of synthesized KIO_3 in different salt samples through storage studies (April – June 2025)

b. Experimental material of the Project:

- i. Screening & selection of best method for lab scale production of KIO_3
- ii. Optimum yield & absolute purity of potassium iodate (KIO_3) will be determined
- iii. Efficacy studies to determine the retention time of KIO_3 as a fortificants
- iv. Qualitative and quantitative analysis of KIO_3 fortified salt samples and storage study under different conditions of temperature and humidity

c. Expected tangible of the project:

Method Optimization for Lab-Scale Production of Potassium Iodate (KIO_3)

PLANT BREEDING & GENETICS DIVISION (PBGD)**PBGD-1: HORTICULRUTE GROUP****PBGD-1-1:**

1. Project Title: Improvement of Plum for Higher yield and better fruit quality using induced mutations/introduction.
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Roshan Zamir, DCS/Head PBGD
4. Team members (Scientists & Staff): Mr. Shahid A. Khalil, PS, Mr. M. Tariq, PSA, & Mr. Mustaqeem Shah, G. Att.
5. Project Objectives: Development of high yielding (50-60 Kg /tree) and better fruit quality (color and taste) plum genotypes through induced mutations/introduction
6. Background and Justification: Plum is an important fruit crop of Khyber Pakhtunkhwa province of Pakistan due to the prevailing conducive agro climatic conditions. In Pakistan it is produced on area of 6.5 thousand hectares with total production of 49.8 thousand tones. Despite a significant growth, the fruit yield/production is very low. The reasons are numerous, including non-availability of improved varieties and certified fruit nurseries of plum for the commercial orchard growers. Therefore, improvement of plum for high yield & better fruit quality through different approaches is essential. Initially the local selections and mutants of plum are under evaluation for fruit characteristics & quality.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24: Local germplasm of Santa Rosa, Red Beauty, Blasting Star and Fazli Manani along with 9 mutants (20 and 30 GY) were evaluated for morphological characters in orchard. First blooming in Fazli Manani were recorded but could not reach to fruiting, therefore fruiting data could not be recorded. It is expected to come into bearing in coming season.
 - b. Patent/Lab Accreditation/Product certification/ Licensing/ Commercialization by authorized department during 2023-24: NA
 - c. Pre-Basic/ Basic seed produced at NIFA and sold: NA
8. Expenditure on last year experiment:

S.#	Items	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	--
2.	Total laborer charges (both from project & NIFA)	3000
3.	Total POL (calculated by farm branch per acre)	15715/-
Total		18713/-
9. Income Generation (Rs):NA
10. Detail of ongoing funded research project (s) as PI only during 2023-24: Nil
11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory
 - i. Recording of morphological data on height, Branches and blooming of local germplasm of Fazli Manani, Red beauty, Santa Rosa and Blasing Star (July-August 2024 & Feb-March 2025)
 - ii. Evaluation of individual Mutant plants (20 & 30 Gy) of Plum for morphological characteristics (Jan-March 2025)
 - iii. Selections/collection of desired plum plants (land races) for further budding. Collection of selected bud wood for budding on the rootstock. (Oct & Nov 2024)
 - iv. Visits to various plum orchards of farmer's fields at fruiting/blooming stage. (Feb-March & May-June 2025)
- b. Experimental material of the Project:
 - i. Fazli Manani (16 plants), Red Beauty (09), Santa Rosa (08 plants) and Blasting Star (02 plants)
 - ii. Fazli Manani Mutants (09 plants)20 Gy (06 plants) and 30 Gy (03 plants)
- c. Expected tangible outcome of the project:

Selection of best plum genotypes for the agro-climatic conditions of Pakistan

PBGD-1-2:

1. Project Title: Improvement of peaches for yield and quality:
2. Funding Source Type: PAEC/PSF
3. Principal Investigator: Mr. Shahid Akbar Khalil, PS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives: Development of short stature, high yielding (30-35) and quality peach genotypes through induced mutations/introduction/selection.
6. Background and Justification:

Due to large tree size it is desirable to introduce dwarf/early maturing peach varieties of this commercially important fruit crop in order to increase the efficiency of orchard operations. Compact/early maturing varieties of peaches are not only smaller in size but more productive in relation to their size. Keeping these facts in view and importance of peach in fruit industry of Pakistan this research project was initiated at NIFA, Peshawar.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Plawhite-5, a white-fleshed peach, is ready for harvest 13-15 days before the Early Grand.
 - ii. Plawhite-5 has a semi-dwarf growth habit, high yielding with a TSS value of 9-10, as well as attractive fruit color and shape.

- iii. Zingle-4 is an attractive red color nectarine with a high TSS value of 10.0 and matures early, ready for harvest in the third week of April.
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24:
 - c. Pre-basic/Basic seed produced at NIFA and sold: N. A.
8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	10000/-
2.	Total laborer charges (both from project & NIFA)	16200/-
3.	Total POL charges	25000/-

9. Income Generation (Rs):
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
- a. Experimental activities at field/ laboratory
 - i. Sprouting, flowering, fruiting and yield data collection (Jan-March 2025)
 - ii. Data recording fruit quality parameters (April-June 2025)
 - iii. Data recording fruit quality parameters (Jul-Sept 2025)
 - b. Experimental material of the Project:
 - i. Exotic genotypes (61 plants)
 - ii. 04 new selections with Total 45 plants
 - iii. selection in Charsadda 19 plants
 - iv. Mutant plants of Early Grand & Florida King 29 plants
 - c. Expected tangible outcome of project:

Developing high yielding peach genotypes

PBGD-1-3:

1. Project Title: Sustainable approaches for effective control of peach stone replant Disorders
2. Funding Source Type: PAEC/PSF
3. Principal Investigator: Mr. Shahid Akbar Khalil, PS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives:

To investigate the effect of fumigants, biofumigants and biochar on plant vigor, growth of peach under replant condition in nurseries.
6. Background and Justification:

Peach stone replant disorder is a serious problem for stone fruits growers and once the land used for stone fruits nursery, the soil cannot be used again for many years, due to HCN toxicity in the soil. Similarly, peach stone nursery growers having small land holding cannot afford to hire new land for the production of stone fruits nursery plants. Therefore, chemical fumigation (1,3-dichloropropene, chloropicrin, dimethyl disulfide, methyl iodide), bio-fumigation (chicken manure, compost, mustard etc) and biochar alone or in combinations is an alternate sustainable strategy to combat/manage peach replant disorder.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

- i. Different bio-fumigants were applied to peach nursery field, the application of 5 kg/plot mustard cake showed better results regarding germination % as compared to other treatments and control.
- ii. The highest plant survival rate was noted in mustard cake treated soil.

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader): NA

8. Expenditure on last year experiment

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	20,000/-
2.	Total laborer charges (both from project & NIFA)	162,000/-
3.	Total POL charges	4000/-

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24

Project title	Total budget (Rs.)	Duration
Sustainable Approach for Effective Control of Peach Stone Replant Disorders	2.8 million	2022-2025

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Peach Stone Sowing (Oct-Dec 2024)
- ii. Pre-budding data collection and Uprooting of nursery plants (Jan-March 2025)
- iii. Pre-budding data collection and budding on rootstock (April-June 2025)
- iv. Untying, folding, removal of upper portion and Post-budding data collection (Jul-Sept 2025)

b. Experimental material/brief summary of the Project:

- i. Application of fumigant i.e., control (untreated), 50 ml of 1,3-dichloropropne, 50 ml of chloropicrin, 150 ml of dimethyl disulfide and 20 ml of methyl iodide.
- ii. Evaluation of seedlings for peach replant disorder
- c. Experimental tangible outcome of the Project:

The reclaimed nurseries field will be repeatedly used for raising peach stone nursery growers

PBGD-2: PULSES GROUP**PBGD-2-1:**

1. Project Title: Breeding high yielding and large seeded mungbean genotypes through induced mutation and cross breeding techniques
2. Funding Source Type: PAEC & PARC-PSDP Pulses Project:
3. Principal Investigator: Dr. Iqbal Saeed, PS
4. Team members (Scientists & Staff): Dr. Gul Sanat Shah, DCS, Mr. Shahzad Ahmad, JS, Mr. Nizam Shah, SA-I, Mr. Nasir Khan, SA-II, Mr. Anwar Ali, G. Attendant
5. Project Objectives: Developing/evolving high yielding (2-2.5 t/ha) mungbean varieties for agro-climatic conditions of KP
6. Background and Justification: Green and black-seeded are two types of mungbean with black-seeded is the sole type being grown in Kurram on an estimated area of 3473 hectares. Development of shiny black-seeded and high yielding mungbean varieties will increase overall production of mungbean in KP in particular and the country in general
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Green-seeded mungbean variety “NIFA Mung-24” was recommended by the VEC for general cultivation in KP in its meeting on 16-04-2024 at PARC
 - ii. 1st year DUS of two black-seeded candidate lines was carried-out
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: N/A
 - c. Pre-basic/Basic seed produced at NIFA and sold **(Only by Group Leader)**

2022-23						
Variety Name	Area (Acre)	Category/Lot no.		Production (Kg)		
		Category	Lot no.	Total	Sold	Remnant
Ramzan	0.6	Pre-basic	PR-1499205	80	80	-
NIFA Mung-19	1.0	Pre-basic	PR-1499206	130	130	-
NIFA Mung Spinhar-21	1.0	Pre-basic	PR-1499207	200	200	-
NIFA Mung Sikaram-21	0.45	Pre-basic	PR-1499208	100	100	-
NIFA Lobia Red-22	0.35	Pre-basic	PR-2189891	70	70	-

12023-24						
Variety Name	Area (Acre)	Category/Lot no.		Production (Kg)		
		Category	Lot no.	Total	Sold	Remnant
Ramzan	0.25	Pre-basic	PR-1499211	40	40	-
NIFA Mung-19	0.35	Pre-basic	PR-1499212	50	50	-
NIFA Mung Spinhar-21	0.45	Pre-basic	PR-1499213	70	70	-
NIFA Mung Sikaram-21	0.45	Pre-basic	PR-1499214	70	70	-
NIFA Lobia Red-22	0.50	Pre-basic	Awaited	80	-	-
NIFA Lobia Yellow-22	0.10	Pre-basic	-do-	30	-	-

¹For unprocessed seed the crop inspection No if has allotted may be provided

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	150,000/-
2.	Total laborer charges (both from project & NIFA)	200,000/-
3.	Total POL charges	125,720/-
Total		475,720/-

9. Income Generation (Rs): N/A

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Promoting research for productivity enhancement in pulses (PI: Dr. Gul Sanat Shah, CS/Director)	24.446 million	2019-2025

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Sowing of experimental material (July, 2024) and seed multiplication at NIFA
- ii. Field data collection (July-Sep., 2024)
- iii. Evaluation of early and later segregating material (August-Sep., 2024)
- iv. Creation of new genetic variability (July-August, 2024)
- v. Harvesting and post-harvest operations (Oct-Dec, 2024)
- vi. Post-harvest data collection (Jan-Mar., 2025)
- vii. Cleaning and preparation of material for next sowing (Mar-June, 2025)

b. Experimental material of the Project:

- i. Yield trials: ALYT (01 set): 20 ent. PYT (04 sets): 80 ent. Adap. Trial (01 set): 06 ent. NUYT (01 set): 19 ent.
- ii. Segregating populations: F₃/M₃: 07 cross-comb. F₄/M₄: 10 cross-comb.
- c. Expected tangible outcome of the project:
Selection of best genotype(s) for development of commercial variety(s)

PBGD-2-2

1. Project Title: Breeding high yielding kidney bean genotypes through induced mutation and cross breeding techniques.
2. Funding Source Type: PAEC and PARC-PSDP Pulses Project
3. Principal Investigator: Mr. Shahzad Ahmad, JS
4. Team Members (Scientist & Staff): Presented by Group Leader
5. Project Objective(s): Evolving high yielding (2-2.5 t/ha) kidney bean varieties for agro-climatic conditions of the KP.
6. Background and Justification: Kidney bean is an important potential crop of KP. Currently, Kurram is the primary region where kidney bean is grown as a sole crop. To boost national kidney bean production, developing high-yielding varieties is essential. This will play a significant role in enhancing overall production of kidney bean in the country.
7. Summary of last year research work:
 - a. Tangible research work findings during 2023-24:
 - i. Conducted 2nd year DUS of a candidate line NKB-Kenya in spring 2024.
 - ii. NKB Kenya produced average significant higher yield in adaptability yield trial.
 - b. Variety approval/ Patent/Lab Accreditation/Product certification/ Licensing/ Commercialization by authorized department during 2023-24: NA
 - c. Pre-basic/Basic seed production at NIFA and Sold: Provided by group leader: NA
8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	40,000/-
2.	Total laborer charges (both from project & NIFA)	144,000/-
3.	Total POL charges	47,145/-
Total		231,145/-
9. Income Generation (Rs): N/A
10. Detail of ongoing funded research project(s) As PI during 2023-24: NA
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:

- i. Harvesting and threshing (July-Sep, 2024) / Planting of adaptation trial outside NIFA (July-Oct, 2024) and Cleaning & post-harvest data collection (Oct-Dec, 2024) / Seed and field preparation of material for sowing (Jan-Feb, 2025)
 - ii. Planting of experimental material and seed multiplication (Feb-March, 2025)
 - iii. Field data collection, evaluation of expt. material & hybridization (April-June, 2025)
- b. Experimental material of the Project:
- i. Yield Trial: Replicated yield trial: 15 entries & Adaptation trial: 04 entries
 - ii. Segregating populations: F₁/M₁: 02 cross-comb., F₂/M₂: 04 cross-comb., F₃/M₃: 03 cross-comb., M₁: 02 parents, M₂: 02 populations, M₃: 01 population
 - iii. Germplasm evaluation: 50 entries and Crossing block (04 parents)
- c. Expected tangible outcome of the project:
- Selection of best genotype(s) for development of commercial variety(s).

PBGD-3: OIL SEED BRASSICA GROUP**PBGD-3.1**

1. Project Title: Genetic improvement of oilseed brassicas through induced mutations and hybridization techniques
2. Funding Source Type: PAEC/ALP
3. Principal Investigator: Hafiz Munir Ahmed, PS
4. Team members (Scientists & Staff): Mr. Abdul Haseeb Durani, SSA Mr. Wisal Khan, SA-III and Mr. Farooq Ahmed Khan (RF ALP/CS-379)
5. Overall Project Objectives: Development of high seed ($\geq 1200 \text{ kg ha}^{-1}$) and oil yielding ($\geq 40\%$) rapeseed & mustard varieties
6. Background and Justification:

Pakistan is facing a severe shortage of edible oil, with only 12% of its needs met by domestic production. The rest is imported, putting a strain on the national budget. Rape and mustard, known as Brassica oilseeds, are a significant source of vegetable oil in Pakistan, making up about 31% of domestic production. To address this, NIFA has developed high-yielding five improved rapeseeds and one improved mustard variety and dedicated to further develop improved varieties for general cultivation to boost domestic oil production and reduce reliance on costly imports.

7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. NIFA Raya-T24 (MM-31-5) submitted to VEC for recommendation
 - ii. Second year Distinctive, Uniformity and Stability (DUS) studies of RR-8-2 has been completed in collaboration with FSC&RD.
 - iii. The rapeseed mutant RM-1-5 yielded 1274 kg/ha, outperforming the check Super Canola (1270 kg/ha) for the second consecutive year in NURYT (2023-24).
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
 - c. Pre-basic/Basic seed produced at NIFA and sold:

2022-23						
Variety Name	Area (Acre)	Category/Lot no.		Production (kg)		
		Category	Lot no.	Total	Sold	Left over
NIFA Sarson-T20	1/8 th	Basic	PR-2226784	20	20	-

2023-24						
Variety Name	Area (Acre)	Category/Lot no.		Production (kg)		
		Category	Lot no.	Total	Sold	Left over
NIFA Sarson -T20	1/8 th	PBS	K-PEW-NIfFaANP-024-7-47586-69209	30	Committed	-
NIFA Sarson -T23	1/8 th	PBS	K-PEW-NIfFaANP-024-7-47616-69210	40	Committed	-

¹For unprocessed seed the crop inspection No if has allotted may be provided

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	25,000/-
2.	Total laborer charges (both from project & NIFA)	333,000/-
3.	Total POL charges	86,000/-

9. Income Generation (Rs):

Activity	Total sale	*Expenditure	Profit
Oil seed analysis	344	-	5160

It will not include establishment charges

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Development of High Yielding Rapeseed Mutants Adaptable to Rain-fed Areas in KP through Nuclear Intervention (CS379)	Rs. 3.169 (million)	2022-23 to 2025-26

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Selection, seed preparation and dispatch of elite rapeseed lines for NURYT and ZVT (July-Sep. 2024)
- ii. Selection, seed preparation and sowing of brassicas experimental materials and seed multiplication trials (July – Oct. 2024)
- iii. Crop husbandry and germination data recording (Nov. 2024 – Feb. 2025)
- iv. Hybridization and data recording. (Jan– March, 2025)

- v. Harvesting and threshing and cleaning of experimental material (April -July, 2025)
- vi. Quality profiling of oilseed breeding material / germplasm (Sep 2024 to Aug, 2025).
- vii. Submission of new rapeseed/mustard candidate variety proposal to VEC (Sep 2024 & March 2025).

b. Experimental material/brief summary of the Project:

- National Uniform Rapeseed Yield Trial: # Ent. =02 entries & Locs. =04
- Zonal Varietal Trial (ZVT): #Ent. =24 & # Locs. =04
- Advanced Yield Trials (AYTs) = 05: # Ent. = 18
- Preliminary Yield Trial (PYTs)=04: # Ent. = 40
- Breeding generations: 586 genotypes will be planted in NRPT and plant to progeny rows.
- DUS Trial: #Ent=01 (rapeseed)
- Seed production: BNS (All six varieties)
- PBS: NIFA Sarson-T20 & NIFA Sarson-T23
- Hybridization: 02 cross combinations
- Quality analysis of all breeding and trials materials will be done through NIRS.
- Candidate varieties: NIFA Raya-T24 & NIFA-RT25
- ALP/CS-379: ppr trial (M₃) (# Ent=160)
- Evaluation under rainfed env. # Ent (M₄-M₅) =07

c. Expected tangible outcome of project:

High seed, oil yielding and widely adaptable brassicas lines will be selected for developing new variety (ies).

PBGD-4: WHEAT GROUP**PBGD-4-1**

1. Project Title: Evaluating Exotic and New Wheat Genotypes for Yield and Related Traits through Hybridization, Mutation, and Multi-Location Trials
2. Funding Source Type: PAEC/AIP
3. Principal Investigator: Dr. Muhammad Irfaq Khan, PS
4. Team members (Scientists & Staff) only by Group Leader:

Dr. Syed Tariq Shah was active member of Wheat Irrigated Group since 09-07-2024. (Dr. Farooq-e- Azam, PS, Dr. Dr. Salman Ahmad, PS, Dr. Akhtar Ali, SS, Mr. Muhammad Naseer, SSA, Mr. Muhammad Arshad, SA-III, Mr. Muqem Jan, General Attendant)

5. Project Objectives: (1-2 points in 2-4 lines):

Develop high yielding wheat varieties for commercial cultivation in Khyber Pakhtunkhwa's through selection, hybridization, and induced mutation, while ensuring the genetic purity of existing varieties.

6. Background and Justification:

To boost crop yields, combat emerging diseases, and adapt to climate change, developing genetically improved varieties is crucial. At NIFA, Irrigated Wheat Breeding Team is dedicated to achieving this through innovative breeding techniques. Notably, our Irrigated Wheat Breeding Group has successfully released five high-performing varieties, with several more in the pipeline, to enhance wheat productivity in Khyber Pakhtunkhwa's irrigated regions.

7. Summary of last year research Work:

- a. Tangible research work findings during 2023-24:

- i. Two genotypes, CT-18062 and CIBW-2, evaluated in the National Uniform Wheat Yield Trials (NUWYT). They showed promising results, with CT-18062 ranking 8th in Khyber Pakhtunkhwa and 9th in Pakistan, yielding 4381 kg/ha, a 4.8% increase over the standard check Arooj-22. Meanwhile, CIBW-2 excelled, ranking 4th in 11th KPWYT with a yield of 6104 kg/ha, surpassing the high-yielding check by 6.3% and demonstrating yellow rust resistance (RRI 8.83). According to the latest NUWYT results (2023-24), CT-18062 ranked 2nd in Khyber Pakhtunkhwa, yielding 3835 kg/ha, surpassing the standard check variety Akbar-19 (3661 kg/ha) by 4.8%. Nationally, it secured the 28th position with a yield of 4178 kg/ha and demonstrated resistance to yellow rust (RRI of 8.51). Notably, CIBWT performed at the country level, producing 3893 kg/ha and showcasing strong resistance to yellow rust (RRI 8.51). The results of the 12th KPWYT are awaited.
- ii. Two genotypes CT-18062 and CIBW-2 from NUWYT, were evaluated in a DUS trial to assess their distinctness, uniformity, and stability.

- iii. Twenty advanced lines were submitted to the National Wheat Disease Screening Nursery (NWDSN) at NARC, Islamabad, for evaluation against prevailing diseases. Satisfactory results have been received from the concerned party.
- iv. Five high-yielding genotypes (CTES-141, CTES-136, CTES-107, CTES-114, and CIBW-5) were entered into the 12th Khyber Pakhtunkhwa Wheat Yield Trials (KPWYT), the results are still awaited.
- v. Seed of NIFA NIJAT and advance lines from NUWYT and NUWYT as well as KPWYT of the previous year were multiplied on limited area.

Segregating populations

- i. Seventy-nine genetically diverse genotypes were planted in the field as a gene pool on two separate dates, yielding seeds from twenty-three successful cross combinations for F₁ generation in the next cropping season.
 - ii. The F₁ generation from ten cross combinations was successfully harvested and will be raised as the F₂ population in the next cropping season.
 - iii. The M₁ generation, resulting from seed treatment of Fakhr-e-Sarhad, was harvested and will be raised as the M₂ generation in the next cropping season.
 - iv. Twenty-three desirable recombinants, exhibiting disease resistance, high tillering capacity, medium plant height, early maturity, and bold seeds, were selected from the F₂ population derived from five cross-combinations.
- b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: N.A.
- c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader)

2022-23						
Variety Name	Area (Acre)	Category/Lot no.		Production (Kg)		
		Category	Lot no.	Total	Sold	Left over
Fakhre NIFA	0.5	Pre-basic	PR-2160606	500	450	50
NIFA Lalma	5.75	Pre-basic	PR-2160608	13100	5275	7825
NIFA Awaz	4.0	Pre-basic	PR-21606010	2500	2500	0
		Approved	PR-2160611	3100	850	2250
NIFA Nijat	0.5	Pre-basic	PR-2160609	450	350	100
NIFA Aman	01	Rejected	-	900	900	-

¹2023-24

Variety Name	Area (Acre)	Category/Lot no.		Production (Kg)		
		Category	Lot no.	Total	Sold	Left over
NIFA Lalma	1.2	Pre-basic	09	2300		
Fakhre NIFA	3.8	Pre-basic	10	7500		
NIFA Awaz	3	Pre-basic	11	3950		
NIFA Aman	1	Pre-basic	12	1600		
NIFA Nijat	3	Pre-basic	13	6100		
Total	12			21450		

¹For unprocessed seed the crop inspection No if has allotted may be provided

8. Expenditure on last year experiment

S. #	Purpose	Expenditures (Rs)		
		Seed	Expt.	Total
1.	Total consumable charges	340,000	6,500	40,500
2.	Total laborer charges (Fom project & NIFA)	382,000	75,000	457,000
3.	Total POL charges	377,000	125,000	50,2000
Total		1,099,000	206,500	999,500

9. Income Generation (Rs): Nil

10. Detail of ongoing funded research project (s) as PI only during 2023-24: Nil

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Select seeds based on desirable characteristics, fumigate/clean/prepare seeds, and dispatch them to collaborating centers for coordinated trials (July to September).
- ii. Prepare the land, plant trials according to the predetermined design, and ensure proper soil conditioning and irrigation (Oct-Dec).
- iii. Inspect and maintain trials by filling gaps, thinning, weeding, and hoeing; record data on agronomic traits, disease response, and pest incidence (Jan-March)
- iv. Record data on various traits, including yield, quality, and maturity; harvest, thresh, and store the harvested material properly to preserve its integrity (April-Jun).

b. Experimental material/brief summary of the Project:

- i. Selection and preparation of up to 80 wheat genotypes for NUWYT, KPWYT-I, and KPWYT-II trials, and up to 4 genotypes for DUS Trial.

- ii. Planting of NUWYT, KPWYT-I, and KPWYT-II trials with up to 80 genotypes, and DUS Trial with up to 4 genotypes, in three replications. Of the above material in the field
- c. Expected tangible outcome of project:
Development of new wheat varieties with improved yield, disease resistance and other traits

PBGD-4-2

1. Project Title: Wheat improvement for high yield and stress tolerance
2. Funding Source Type: PAEC / AIP
3. Principal Investigator: Dr. Farooq-i-Azam, PS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives: Development of wheat cultivars / genotypes with enhanced grain yield (5000 kg ha^{-1}), biotic (Yellow rust, leaf rust) and abiotic (drought) stresses
6. Background and Justification: Sixty percent wheat cultivated area in Khyber Pakhtunkhwa (KP) comes under rainfed conditions. NIFA has released 07 high yielding and disease resistant rainfed wheat varieties which are playing a vital role in boosting per acre yield. Wheat breeding is a continuous process and new varieties are regularly needed either to replace the old ones or to supplement the existing stock of varietal complex. KP has a diversified varietal complex but the average yield is still low. Frequent changes in the climate have been observed in the province and the crop is suffered due to high temperature, drought and water shortage. New high yielding cultivars with abiotic stress tolerance are needed for cultivation in these areas.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - Conducted DUS of 02 candidate wheat lines (NRL 1901 and NRL 1908)
 - Contributed 02 candidate lines (NRL 1901 and NRL 1908) to NUWYT. NRL 1901 ranked 2nd (3604 kg ha^{-1}) on KP basis and 3rd (3812 kg ha^{-1}) on Pakistan basis.
 - Contributed 06 elite lines to KPWYT (NRL 2122, NRL 2112, NRL 2101, NRL 2123, NBL 1701 and NBL 2024). NRL 2112 ranked 5th (irrigated conditions) and NRL 2122 ranked 7th (rainfed conditions) on grain yield basis.
 - Contributed 10 lines to National Uniform Wheat Disease Screening Nursery. NRL 2212, NRL 2213, NRL 2215, NRL 2225, NRL 2239 and NBL 21071 showed desirable ACI values for both yellow and leaf rust.
 - Five lines (NRL 2225, NRL 2226, NRL 2239, NBL 21167, NBL 21071) were selected from AYT (Grain Yield $> 5185 \text{ Kgha}^{-1}$)

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

c. Pre-basic/Basic seed produced at NIFA and sold **(Only by Group Leader)**

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	90000
2.	Total laborer charges (both from project & NIFA)	126000
3.	Total POL charges	94290

9. Income Generation (Rs): Nil

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Evaluation and deployment of multiple stress tolerant bio fortified wheat germplasm in Khyber Pakhtunkhwa (GWP-2023-077)	826839	2023-24

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory with duration) Month wise

- i. Planning and sowing of trials and wheat breeding material (Oct-Dec)
- ii. Agronomic and disease data scoring. Regular Inspection of progeny blocks, progeny rows and seed multiplication blocks of advanced wheat lines (Jan. – Mar.)
- iii. Agronomic and disease data scoring, harvesting and threshing (Apr. – June).
- iv. Seed cleaning of wheat lines, yield data recording, statistical analysis and final lines selection (July – Sept.)

b. Experimental material/brief summary of the Project:

- Advanced yield trials: AYT-Irrigated (20#), AYT-Rainfed (20#), AYT-Heat (20#)
- Coordinated Trials: AARI Trial (200#), NIBGE Trial (200#), CCRI Trial (80#)
- BNS: Progeny blocks (400), Progeny rows (400)
- Seed multiplication: Candidate lines (04#) Advanced lines (10#)

c. Expected tangible outcome of project:

Development of high yielding and disease resistant lines / varieties

PBGD-4-3

1. Project Title: Screening and evaluation of exotic/local wheat nurseries and trails for high yield

2. Funding Source Type: PAEC, AIP

3. Principal Investigator: Dr. Salman Ahmad, PS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives: Development of high yielding ($> 5000 \text{ kg ha}^{-1}$), rust resistant, heat and drought tolerant wheat germplasm and varieties
6. Background and Justification: The development of wheat germplasm adapted to local environments with improved tolerance to various abiotic and biotic stresses results from the evaluation of the advanced and elite genotypes. The result of these efforts is the introduction of novel, highly productive, resistant to disease, and extensively acclimated cultivars for agricultural use.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Eight wheat elite genotypes evaluated in replicated trails for physiological assessment to drought and heat tolerance under irrigated, rainfed and late sowing conditions. Two genotypes NRL-1664 and NRL 2244 exhibited low canopy temperatures, high NDVI, high 1000 grain weight and yield in comparison to check varieties Lalma and Abar-19.
 - ii. Screening of ACIAR germplasm and wheat genotypes from nurseries and trials against yellow rust. 110 genotypes with desirable rust reaction were selected.
 - b. Patent/ Lab Accreditation / Product certification / Licensing / Commercialization by authorized department during 2023-24: Nil
 - c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader): NA
¹For unprocessed seed the crop inspection No if has allotted may be provided
8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	20000
2.	Total laborer charges (both from project & NIFA)	40000
3.	Total POL charges	31430
9. Income Generation (Rs) Nil
10. Detail of ongoing funded research project (s) as PI only during 2023-24 Nil
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. Post-harvest data analysis, selection & seed preparation for next sowing (July-September 2024)
 - ii. Sowing of experimental material and crop husbandry practices (Oct-December 2024)
 - iii. Field data collection and disease scoring (Jan-March 2025)

- iv. Data recording, harvesting and cleaning of material (April-June 2025)
- b. Experimental material/brief summary of the project:
 - Yield Trials (100 entries): PYT-1, PYT-2, PYT-3, PYT-4, Expected Exotic Trials
 - Nurseries (400 entries): NWON, ACIAR Germplasm Expected CIMMYT / ICARDA Nurseries
- c. Expected tangible outcome of the project:

Selection of desirable wheat genotypes for further assessments and conversion into varietal development

PBGD-4-4

1. Project Title: Wheat breeding for yellow and leaf rust resistance and moisture stress
2. Funding Source Type: AIP/PAEC
3. Principal Investigator: Dr. Akhtar Ali, SS
4. Team members (Scientists & Staff) only by Group Leader: N.A
5. Project Objectives:
 - I. Development of parental lines for disease resistance (yellow and leaf rust)
 - II. Pyramiding of rust resistance genes in high yielding genotypes/varieties
6. Background and Justification:

Wheat is the staple crop of Pakistan and essential for its food security. Under the current scenario of climate change, frequent emergence of new rust races is continuously threatening wheat productivity. Many high-yielding varieties become susceptible shortly after release, primarily due to a lacking resistant gene. In such scenario widespread rust epidemics can lead to crop failure when planting susceptible varieties. Under such conditions diverse sources of resistance are the only tools for rust management to ensure sustainable crop production. Ongoing efforts focus on developing potential genotypes with enhanced yield potential, disease resistance, and adaptability to the changing climate. A number of donor parents with known rust resistant genes have been developed. Leveraging these parents in breeding programs will contribute to the development of rust-resistant and high-yielding wheat cultivars contributing to sustainable wheat production, improved food security, and reduced economic losses to farmers.
7. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. 25 fresh cross combinations were successfully attempted
 - ii. 17 different F₁ were raised and seed was bulked harvested individually
 - iii. 73 desirable plants selected in F₂ segregating population (04 cross combination)
 - iv. 80 progenies selected in F₃ Generation (11 cross combinations)

- v. 9 progenies selected in BC₃F₄ Generation (02 cross combinations)
 - vi. 160 plants were selected in M₂ Generation of NF-52, NF53, NBL21026, NBL21030 (200G, 300G)
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NA
 - c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader): NA
8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	30000
2.	Total laborer charges (both from project & NIFA)	42000
3.	Total POL charges (Rs. 31430/-calculated by farm branch per acre)	31430

9. Income Generation (Rs): NA
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NA
11. Planned research work for the year 2024-25:
- a. Experimental activities at field/ laboratory:
 - i. Planning / sowing of wheat breeding material (Oct-Dec)
 - ii. Field screening, selection and crossing (Jan-Mar)
 - iii. Final field selection and spike collection (Apr-Jun)
 - iv. Final selection (July-Sep)
 - b. Experimental material/brief summary of the project Crossing blocks (20 entries) F₁ (25 cross combinations) F₂ (17 cross combinations) F₃ (73 progenies, 4 cross combinations) F₄ (80 progenies, 11 cross combinations) M₃ (160 progenies)
 - c. Expected tangible outcome of the project
Identified and selected rust resistant plants / progenies as future varieties

PBGD-4-5

1. Project Title: Evaluation of exotic wheat germplasm for high yield and disease resistance received from CIMMYT /CIB, CAS, China
2. Funding Source Type: PAEC/Pak-China Project:
3. Principal Investigator: Dr. Syed Tariq Shah, PS
4. Team members (Scientists & Staff): Mr. Mujahid Hameed, SSA, Mr. Zia ul Haq, SA-IV
5. Project Objectives:
 - i. Development of high yielding (5000 kg/ha) and disease resistance wheat varieties for commercial cultivation in KP

- ii. Development of genetically improved wheat genotypes through introduction/selection/ hybridization for further evaluation in NIFA Observation Nurseries and Yield Trials

6. Background and Justification:

Development of new high yielding, disease resistant and early maturing wheat varieties are indispensable for boosting wheat yield in the province/country. Selection of improved wheat genotypes from exotic wheat germplasm are the prerequisites for onward testing in different yield trials. The ongoing efforts have resulted several improved wheat genotypes that are now under trial in PYT and AYT to be developed and released as improved varieties.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

- i. CIBW-2 ranking 4th in KPWYT with 6104 kg/ha, high-yield over check varieties by 6.3% and yellow rust resistance (RRI 8.83). The line showed low yield over checks in NUWYT (2023-24).
- ii. First years mandatory DUS completed of candidate line (CIBW-2).

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader) Nil

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	50000/-
2.	Total laborer charges (both from project & NIFA)	40000/-
3.	Total POL charges	15715/-

9. Income Generation (Rs):

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Cooperative agreement for mutual trial planting of wheat varieties between China and Pakistan	4600/- USD	03 years
		02 years

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Seed cleaning, Post-harvest data recording, completion and analysis (Jul-Sept, 2024)
- ii. Report writing, preparation of wheat material and sowing (Oct-Dec, 2024)
- iii. Data recording in field (Jan-March, 2025)

- iv. Data recording and crop harvesting (April-June, 2025)
- b. Experimental material/brief summary of the project:
PYT (06 entries)
- c. Expected tangible outcome of the project:
Evaluation of experimental material for yield and other related traits to evolved high yielding varieties in future

PBGD-5: VEGETABLES GROUP**PBGD-5-1**

1. Project Title: Breeding of okra (*Abelmoschus esculentus* L.) for high yielding genotypes development through induced mutations and breeding techniques
2. Funding Source Type: PAEC/ALP CS027
3. Principal Investigator: Dr. Syed Tariq Shah, PS
4. Team members (Scientists & Staff): Dr. Roshan Zamir, DCS, Dr. Muhammad Amin, PS, Mr. Mujahid Hameed, SSA & Mr. Zia ul Haq, SA-IV
5. Project Objectives: Development of high yielding (7850 kg/ha) okra varieties for Commercial cultivation in KP

6. Background and Justification:

Khyber Pakhtunkhwa province has enough potential to produce variety of vegetables and a reasonable acreage is available for okra cultivation, but per unit yield is very low. In order to enhance per acre yield of okra, through the proposed project to breed okra genotypes best suited for cultivation under local growing conditions having preferred traits like short stature, medium sized, green fruits, prolonged and fruiting ability through hybridization and induced mutation.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

Two years mandatory DUS completed of candidate line (NBL-1)

b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: Nil

c. Pre-basic/Basic seed produced at NIFA and sold (Only by Group Leader): Nil

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	35000/-
2.	Total laborer charges (both from project & NIFA)	204000/-
3.	Total POL charges	15715/-

9. Income Generation (Rs): Nil

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
Breeding high yielding okra (<i>Abelmoschus esculentus</i> L.) genotypes (ALP-CS027)	2.0 million	03 years

11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory: (Jul-Sept)
 - i. Data recording, compilation, analysis and seed collection (Jul-Sept, 2024)
 - ii. Post-harvest data collection and analysis, report writing, preparation of seed for sowings (Oct-Dec, 2024)
 - iii. Sowing of experimental materials and Irradiation of seeds of selected parents by γ rays (Jan-March, 2025)
 - iv. Data recording, hybridization and harvesting (April-June, 2025)
- b. Experimental material of the Project:
 - i. Yield Trials AYT= 02 PYT= 06Okra Nursery= 15Mutant lines= 05
 - ii. Segregating populations and crossing block
- c. Expected tangible outcome of the project:

Selection of elite genotype(s) for evolution of variety(s) in future

PLANT PROTECTION DIVISION (PPD)**PPD-1: PLANT PATHOLOGY GROUP****PPD-1-1**

1. Project Title: Epidemiology of invasive and non-invasive pathogens of wheat, aphids, resistant genes/sources, and chemical control.
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Syed Jawad Ahmad Shah, DCS
4. Team members (Scientists & Staff): Mr. Usman Khaliq, JS, Mr. Syed Manzoor Shah PSA and Mr. Asif SA-III
5. Project Objectives: To detect and analyze critical local pathogen virulence factors, foster and promote the advancement of disease-resistant germplasm and wheat varieties, investigate the adoption of BYD vectors in commercial, candidate, and elite wheat genotypes, and assess and quantify the risks of post-harvest seed borne diseases in wheat.
6. Background and Justification:
7. Summary of last year's research Work: Agricultural advancements demand better understanding of disease epidemiology, especially in wheat diseases like yellow rust caused by **Puccinia striiformis** (Pst). Northern Pakistan, with its favorable climate and proximity to the pathogen's diversity center in the Himalayas, is particularly vulnerable. Pst virulence adapts to resistant wheat varieties, increasing the risk of new rust races. Effective control strategies involve monitoring pathogen virulence, developing resistant wheat varieties, investigating BYD vector adoption, and assessing post-harvest seed borne disease risks.
 - a. Tangible research work findings during 2023-24:
 - I. Five *Pst* pathotypes were detected, including 0E0, 142E144, 143E128, 6E128, and 142E128.
 - II. Seven resistance genes effective against yellow rust were deciphered.
 - III. Fungicide "Tilit" was found effective against yellow rust.
 - IV. Wheat resistance levels impact on disease progression was established.
 - V. Under the national wheat improvement program, 1203 genotypes were tested and characterized for disease resistance.
 - VI. Karnal bunt and black point risks in seeds of 206 wheat varieties were analyzed and quantified.
 - b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	25000
2.	Total laborer charges (both from project & NIFA)	58
3.	Total POL charges	?

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Planting of experimental material (November, 2024)
- ii. Field experiments inoculations, selfing of differentials (Bagging), and data recording (Feb-June, 2025).
- iii. Manual collection and threshing of bagged spikes from 164 differentials using a spikes thresher (June-July, 2025)
- iv. Harvesting and threshing of experimental material. (June-July,2025)
- v. Post-harvest data recording (August)
- vi. Data entry of field and postharvest results into computer for analysis (September2025)
- vii. Seed cleaning and preparation of experimental material for the next planting (October 2025)

b. Experimental material of the Project:

Yellow rust differential and near Isogenic lines (164 genotypes). 1000 national elite wheat genotypes, 100 national candidate wheat varieties, and 200 released wheat cultivars. Fungicides,5000 Glycine bags, 1000 tags, Tag Rings, Data Registers, Markers, Rubber Bands, Pencils, Foot, Erasers, Sharpeners, Dore, Plastic Rolls, Weedicide, Fertilizer, 300 Cloth Bags, 3000 small Paper Bags. Ten 50 Kg Plastic bags, 6 Kgs Plastic Shopping Bags,

c. Expected tangible outcome of the project

Detection of *Pst* races/virulence and yellow rust resistance genes, fungicide dose standardization, wheat germplasm characterization, and seed health risk assessment.

PPD-2: BIO-CONTROL GROUP**PPD-2-1**

1. Project Title: Management of fruit worm, *Helicoverpa armigera* (Hub.) through egg parasitoid, *Trichogramma chilonis* (Ishii) with bio-pesticides in okra crop.
2. Funding Source Type: PAEC.
3. Principal Investigator: Mr. Muhammad Zahid, DCS.
4. Team members (Scientists & Staff): Mr. Usman Khalique, JS and Mr. Farhat Ullah, SA-III.
5. Project Objectives:
 - i. Bioassay studies of bio-pesticides (plant extracts, Entomo-pathogenic fungi) against fruit worm, *H. armigera* (Hub.).
 - ii. Monitoring of fruit worm moth population through pheromone traps and timely application of Tricho-cards against fruit worm control in okra crop.
6. Background and Justification: Fruit worm, *H. armigera* is a polyphagous insect pest that causes okra damage up to 35-50%. Indiscriminate use of insecticides causes serious issues (health problems, destruction of beneficial insects & threaten the sustainability of agricultural systems). Present studies are therefore of great importance which aims to develop eco-friendly control strategies alternatives to synthetic insecticides.
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Minimum fruit worm infestation was recorded up to 0.21/ plant after application of Tricho-cards (*Trichogramma* = 1000 nos.) followed by 800 T.C. (0.23), 500 T.C. (0.24) and higher in control (0.31/ plant) in tomato crop at $\alpha = 0.05$.
 - ii. Fruit worm, *H. armiger* arearing on chickpea flour-based artificial diet was found very effective with minimum larval-pupal period and high adult emergence and fecundity rate as compared to natural okra and maize flour-based artificial diets.
 - iii. Irradiation dose, 200 Gy displayed sub-sterility in fruit worm moth with minimum egg laying & egg hatching while 250 Gy induced complete sterility where no eggs/egg hatching was recorded as compared to control.
 - b. Patent/Lab. Accreditation/Product certification/Licensing/ Commercialization by the authorized department during 2023-24: NIL.
8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	4,000/-
2.	Total laborer charges (both from project & NIFA)	-
3.	Total POL charges	3920/-

9. Income Generation (Rs): NIL.
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. Maintenance of *Trichogramma* culture in the lab. (July, 2024-June, 2025)
 - ii. Rearing of fruit worms on artificial/ natural diets (Nov., 2024-June, 2025).
 - iii. Bio-assay of bio-pesticides (botanicals/ Entomo-pathogenic fungi) against fruit worm, *Helicoverpa armigera* in vitro condition by following CRD design (Nov, 2024-June, 2025).
 - iv. Lab. data collection (Nov., 2024-June, 2025).
 - v. Sowing of okra crop (March, 2025).
 - vi. Evaluation of egg parasitoid, *T. chilonis* against fruit worm, *H. armigera* in okra by following RCBD (April-June, 2025).
 - vii. Ecological study of fruit worm through pheromone traps in okra crop by following RCBD (March-June, 2025) Field data collection and Statistical analysis (March-June, 2025)
 - b. Experimental material of the Project:

Sitotroga/ Trichogramma/ fruit worm cultures, insect diets, chemicals, glassware, Trichocards, plant extracts, EPF cultures, pheromone traps, okra seed, and sprayer etc.
 - c. Expected tangible outcome of the project:

Integrated pest management of fruit worm through botanical/Entomo-pathogenic fungi, egg parasitoid and pheromone baited traps in okra crop.

PPD-2-2

1. Project Title: Eco-friendly management of tomato fruit worm, *Helicoverpa armigera* (Hub.) and wheat aphid, *Schizaphis graminum* (Rondani) in tomato/ wheat crops.
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Usman Khalique, JS
4. Team members (Scientists & Staff): only by Group Leader: NA
5. Project Objectives:
 - i. Exploration, isolation, identification, and evaluation of naturally occurring entomo-pathogenic fungi in different field crops against borers.
 - ii. Screening of wheat genotypes against aphid resistance.
6. Background and Justification: Tomato fruit worms and wheat aphids are polyphagous insect pests that cause damage to tomatoes (53%) and wheat (35-40%) respectively. Indiscriminate use of insecticides causes serious issues like

health problems, and destruction of beneficial insects and threatens the sustainability of agricultural systems. The present project is therefore, of great importance, which aims to develop eco-friendly control strategies alternatives to synthetic insecticides.

7. Summary of last year's research Work:

a. Tangible research work findings during 2023-24:

- i. Four entomo-pathogenic fungi species (EPF) viz., *Nomuraea rileyi*, *Aspergillus parasiticus*, *Aspergillus flavus*, and *Aspergillus niger* were identified.
- ii. Entomo-pathogenic fungi, *Nomuraea rileyi* was found very effective in controlling the fruit worm larvae among other tested EPF.
- iii. Racer product with the active ingredient of *Beauveria bassiana* was found effective in reducing the fecundity and egg-hatching rate of tomato fruit worms.
- iv. Out of 189 wheat genotypes, 11 were found highly resistant to wheat aphids.
- v. Both garlic and orange peel extracts at 5% showed effectiveness in reducing wheat aphid population as compared to other tested plant extracts.

b. Patent/ Lab Accreditation/Product certification/Licensing/ Commercialization by authorized department during 2023-24: NIL.

8. Expenditure on last year's experiment: NIL.

9. Income Generation (Rs): NIL.

10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL.

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Lab. rearing and culture maintenance of tomato fruit worm (Nov. 2024-June, 2025).
- ii. Culture maintenance of entomo-pathogenic fungi (EPF) on SDAY media (July 2024-June, 2025).
- iii. Tomato nursery planting in pots (March 2025).
- iv. Influence of varying spore concentrations of entomo-pathogenic fungi on oviposition preference of tomato fruit worm on tomato plants by following factorial design (March-June, 2025).
- v. Host plant resistance (HPR) studies in wheat genotypes against aphid (Nov., 2024-May, 2025).
- vi. Compatibility study of *N. rileyi* & *A. parasiticus* with garlic & orange peel extract against aphids by following factorial RCBD (Feb-April, 2025). Data collection & statistical analysis (Feb-June, 2025).

b. Experimental material of the Project:

Chemicals, glassware, insect culture, insect diet, tomato nursery, plastic pots, EPF culture, hemocytometer, micropipettes, wheat material, plant extracts, sprayer etc.

c. Expected tangible outcome of the project:

- i. Identifying optimal dose for product development against fruit worms and aphids.
- ii. Baseline data development for aphids' adaptation to wheat.

PPD-3: MEDICAL ENTOMOLOGY GROUP**PPD-3-1**

1. Project Title: Development of parthenium-based bio-pesticide and ovi-traps/baits for the surveillance and management of deadly mosquitoes.
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Gul Zamin Khan, DCS
4. Team members (Scientists & Staff): Mr. Taufiq Ullah, General Attendant
5. Project Objectives: Development of tools for integrated vector management of dengue mosquitoes.
6. Background and Justification: Sole reliance on synthetic insecticides against dengue mosquitoes poses health and environmental risks and has led to resistance. Consequently, the focus is on indigenous methods such as bio-pesticides and trapping/ baiting techniques. The ongoing efforts aim to develop effective control measures that also have the potential for income generation.
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - i. The bio-pesticides were found highly compatible (96-100%) in various urban and rural mosquito habitats.
 - ii. Trap index showed significant variation in the population dynamics of Culicid mosquito species.
 - iii. Bucket-type large traps were effective in trapping eggs but were not successful in capturing adult mosquitoes, indicating a need for design modifications to be utilized as bait stations.
 - iv. Initial results suggest that combining nanoparticles (silica) with the parthenium formulation is feasible for improving the formulation, leading to a reduction in the dosage of the parthenium formulation.
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year's experiment: NIL
9. Income Generation (Rs): NIL
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. To refine/ optimize the physical design of the traps for maximizing mosquito retention and killing. (July-Nov. 2024)

- ii. Development of collaboration with KP public health to deploy bio-pesticides in their respective field locations. (July 2024- June 2025)
- iii. Modification in dengue guard formulation (Dec 2024-Feb 2025)
- b. Experimental material of the Project:
 - Sugar, molasses, yeast, and 2-methylbutanoic acid, traps with different designs, sticky paste, non-repellent insecticides.
 - Neem, mint and sesame oils combinations; 60:35:5, 50:45:5, 40:55:5, 30:65:5, 25:70:5:55:5, 30:65:5, 25:70:5
- c. Expected tangible outcome of the project:
 - i. Development of traps, baits, and bio-pesticides for maximum effectiveness against deadly mosquitoes.
 - ii. Improved dengue guard formulation

PPD-3-2

1. Project Title: Enhancing the Capacity and the Utilization of the Sterile Insect Technique for *Aedes* Mosquito Control
2. Funding Source Type: IAEA Technical Cooperation (RAS)
3. Principal Investigator: Dr. Gul Zamin Khan, DCS
4. Team members (Scientists & Staff): Mr. Taufiq Ullah, General Attendant
5. Project Objectives:
 - i. Development tools for SIT as long-term sustainable strategies against dengue vectors.
 - ii. Upscaling of mosquito rearing improved sterile male production of mosquitoes, baseline data as per IAEA phase conditional approach for SIT.
6. Background and Justification: Pakistan is a participating country in the current regional Asia project under the IAEA framework. The IAEA's technical cooperation for the application of the Sterile Insect Technique (SIT) in Asian countries focuses on capacity building, including vector surveillance, scaling up insect rearing, and improving sterile male production, in line with the phased conditional approach (PCA) established by the IAEA. The ongoing efforts are thus being carried out with IAEA support toward the application of SIT.
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Five blood sources were optimized for the rearing and production of *Aedes* mosquitoes and can be utilized on an availability basis.
 - ii. The competitive index (C) of sterile males (70-80Gy) was higher in the field cage test and thus fit for SIT.

- b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
- 8. Expenditure on last year's experiment: NIL
- 9. Income Generation (Rs): NIL
- 10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
- 11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
To optimize the sterile vs wild male ratio in field cage test (March 2025-May 2025)
 - b. Experimental material of the Project:
Sterile & wild males, rearing cages, blood feeding sources, larval diet, field cage, ovi-cups, larval trays etc.
 - c. Expected tangible outcome of the project:
Securing funding and technical cooperation from the IAEA for the application of the Sterile Insect Technique (SIT) against Aedes mosquitoes.

PPD-4: TERMITE MANAGEMENT GROUP**PPD-4-1**

1. Project Title: Exploitation of anti-termite potential of local plants for subterranean termite management in urban and agricultural setup.
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Muhammad Misbah ul Haq, PS
4. Team members (Scientists & Staff): Mr. Muhammad Irfan, SS & Mr. Midrarullah, SSA

5. Project Objectives:

Development of organic anti-termite product to replace the synthetic termiticide for ecofriendly management of termites.

6. Background and Justification: Subterranean termites pose a significant challenge for control due to their elusive behavior. Traditional methods, primarily relying on repellent synthetic insecticides, these are costly and environmentally harmful. The present project aims to provide evidence of the efficacy of plant extracts as sustainable and environmentally friendly alternatives for subterranean termite control. It holds the potential to revolutionize termite management by introducing organic, safe, and cost-effective solutions that mitigate the environmental hazards associated with conventional methods.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

- i. Clove extract at 5% and 10% completely restricted trail following of subterranean termites, confirmed by making termites follow a trail drawn by ink containing 2-phenoxyethanol.
- ii. Tunneling in soil by termite workers was also restricted to less than 5% by soaking the foraging arena with 10% clove extract.
- iii. Clove extract at concentrations greater than 5% was on par in toxicity with the best available marketed synthetic termiticide (Fipronil) and can be formulated further as an organic termiticide.

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24:

8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	20000
2.	Total laborer charges (both from project & NIFA)	NA
3.	Total POL charges	NA

9. Income Generation (Rs):

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
IAEA CRP project 44003, Research Contract 24085 (2020-2024) "Hunt for naturally existing tsl mutation in <i>Aedes aegypti</i> and <i>Ae. albopictus</i> for the construction of a more robust Genetic Sex Strain (GSS) for SIT.	24000€	2020-2025

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

Activity 1. Evaluation of toxicity, deterrence of organic formulations of clove extract and clove oil with various organic inert materials. (July – Nov, 2024). Activity 2. Evaluation of residual toxicity, deterrence of effective formulations (Sep 2023 – March 2024). Activity 3. Impact of product on biological attributes of termites (Dec 2023 – May 2024). Activity 4. Comparative evaluation of effective organic clove formulations with synthetic pesticide for the control of subterranean termites (Jan, 2025 – June, 2025).

b. Experimental material of the Project:

Clove extracts, clove oil, Organic solvents, natural emulsifiers, surfactants, essential oils, stabilizers/ antioxidants, clove extract, foraging material, glass ware, chemicals etc. synthetic termiticide.

c. Expected tangible outcome of the project

Development of alternative compatible organic formulation to synthetic termiticide for termite control

PPD-4-2

1. Project Title: Hunt for naturally existing tsl mutation in *Aedes aegypti* and *Ae. albopictus* for the construction of a more robust Genetic Sexing Strain (GSS) for SIT.
2. Funding Source Type: IAEA
3. Principal Investigator: Dr. Muhammad Misbah ul Haq, PS
4. Team members (Scientists & Staff): Mr. Abdul Aziz, Research Associate
5. Project Objectives:
 - a. Collection and up-scaling of *Ae. aegypti* and *Ae. albopictus* from diverse topographic zones in Pakistan at NIFA's Mosquito Laboratory.
 - b. Screening for temperature-sensitive lethal (tsl) mutations in wild dengue vector populations for establishing a genetic sex separation system for enhanced mass-scale sterile insect technique (SIT).
6. Background and Justification: The SIT program of mosquitoes relies heavily on the production and release of large number of sterilized males with efforts to release

zero sterilized female. There is no mechanism available for separation and elimination of female at mass level. Construction of suitable Genetic Sexing Strains (GSS) based on phenotypic markers and temperatures sensitive lethal (tsl) mutation and linking wild-type alleles of these markers to Y-autosome through translocation can improve sex separation. These mutations can be used for creating a strain in which males are more resistant and females are sensitive to heat and can be killed at early larval stages.

7. Summary of last year's research Work:

a. Tangible research work findings during 2023-24:

- i. Twenty iso-male families were developed from a wild population of Aedes mosquitoes and subjected to thermal screening and 6 potential iso-male families were identified.
- ii. Six potentially resistant families were exposed to the same thermal regime as tested before and two colonies were confirmed as resistant to @40°C for 5hrs.
- iii. Exposure of other developmental stages (4th instar larvae and pupae) to thermal screening did not yield significant results; therefore, only 1st instar larvae were recommended for tsl screening.

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	100000
2.	Total laborer charges (both from project & NIFA)	NA
3.	Total POL charges	NA

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24:

Project title	Total budget (Rs.)	Duration
IAEA CRP project 44003, Research Contract 24085 (2020 – 2024) “Hunt for naturally existing tsl mutation in Aedes aegypti and Ae. albopictus for the construction of a more robust Genetic Sex Strain (GSS) for SIT.	240000€	2020-2025

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

Activity 1. Collection of wild Aedes mosquitoes and development of iso-male families (August – Nov 2024) Activity 2. Screening of iso-male families (especially albopictus) for identification of potential resistant families. (June 2024 – Feb 2025). Activity 3. Confirmation of potential iso-male families (Jan – April 2025). Activity 4.

Inbreeding of resistant mass and iso-male colonies for re-confirmation of resistance in next generations (April – June 2025).

b. Experimental material of the Project:

Aedes larvae, ovitraps, aspirators, falcon tubes, plastic trays, mosquito diets, water bath, hatching jars, egg papers, hydro-thermos meters, microscope, iso-male and mass colonies

c. Expected tangible outcome of the project:

Identification and confirmation of heat resistant iso-male families.

PPD-4-3

1. Project Title: Development of local attractive bait matrix and toxin delivery foraging stations for control of subterranean termite' species

2. Funding Source Type: PAEC/PSF

3. Principal Investigator: Mr. Muhammad Irfan, SS

4. Team members (Scientists & Staff): Mentioned by the Group Leaders

5. Project Objectives: (1-2 points in 2-4 lines):

Development of bait technology for the successful management of subterranean termites

6. Background and Justification:(3-5 lines): Subterranean termites are notorious pest of agricultural crops and buildings structure in Pakistan. The use of bait technology for termite management is increasingly popular globally due to its sustainability, eco-friendliness, and ease of use. This research aims to develop termite bait technology and conduct field trials.

7. Summary of last year's research Work:

a. Tangible research work findings during 2023-24:

i. Extracts of used poplar wood (NIFA TERMAP) and crushed termite workers had a positive effect on termite attraction while extracts of decaying wheat straw showed no significant effect.

ii. Similarly, the application guar gum on Poplar wood sawdust showed increased termite aggregation compared to untreated Poplar wood sawdust

iii. Based on the LC 50 and LT 50 (6 days), Lufenuron at 51 ppm with no deterrence was selected for incorporation into the bait matrix.

iv. In lab trials, the bait matrix with the toxin was found less attractive as compared to the bait matrix without the toxin.

v. An average of 1600 termite workers per trap per fortnightly was counted as initial population estimation from four active foraging points established near the NIFA officer Hostel.

vi. Outside the building, the Bait matrix with the toxin showed the lowest termite counts compared to the bait matrix without toxin and poplar wood. Similarly, inside the buildings bait matrix was found poorly detected by termite

vii. In the NIFA agricultural cropping area, termite attacks were not observed on any of the detection stakes installed.

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	20000
2.	Total laborer charges (both from project & NIFA)	
3.	Total POL charges	

9. Income Generation (Rs) NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24

Project title	Total budget (Rs.)	Duration
Development of Local attractive Bait matrix and toxin delivery foraging stations for the control of Pakistani Subterranean termites	2.298	3 years

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

Activity 1. Screening and integration of synthetic cellulosic materials with already screened natural cellulosic materials to enhance termites bait attractions (July-Dec) Activity 2. Evaluation of chemicals that mimic termite trail-following behavior and natural termite feeding preferences (Dec- March) Activity 3. Efficacy trials (Mar- Jun)

b. Experimental material of the Project:

Synthetic cellulosic materials (Alpha cellulose, carboxymethyl cellulose etc) phenoxyethanol, dodecatrien, various amino acids, plastic cups, petri dishes, sand, termites, natural cellulosic materials, IGRs and toxicants etc.

c. Expected tangible outcome of the project:

Development of attractive bait matrix.

PPD-5: FRUIT FLY MANAGEMENT GROUP**PPD-5-1**

1. Project Title: Integrated Management of Fruit Flies
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Muhammad Hamayoon Khan, PS
4. Team members (Scientists & Staff): Mr. Muhammad Salman, SS & Mr. Fazle Rahim, PSA
5. Project Objectives: Development and application of eco-friendly control strategies for sustainable management of fruit flies in horticultural crops
6. Background and Justification: Fruit flies are posing serious threat to horticultural crops across the world. In Pakistan, *Bactrocera* species inflict heavy losses to a wide range of fruits and vegetables. Control of fruit flies largely depends on the application of broad-spectrum pesticides, which are continuously affecting the environment. Present studies are therefore, designed to develop alternative and eco-friendly control methods for fruit fly management with special emphasis on the development of fruit fly bait
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Blends of guava juice, brewers' yeast, and ammonium acetate (in a ratio of 16:4:3) were highly effective in locally designed traps for mass trapping and population suppression of *Bactrocera* species in guava orchard.
 - ii. Among different ripening stages, fully ripe fruits were significantly preferred by *Bactrocera zonata* over unripe and ripe fruits. Guava emerged as the most preferred fruit, closely followed by bananas, establishing them as the most suitable natural hosts for large-scale laboratory production of *B. zonata*.
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	10,000/-
2.	Total laborer charges (both from project & NIFA)	Nil
3.	Total POL charges	Nil
9. Income Generation (Rs): NIL
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:

- i. Irradiation of pupae of fruit fly, *B.zonata* and subsequent data collection (Jul-Aug 2024).
 - ii. Pupal sifting of F1 generation and subsequent study on biology (Sept-Oct 2024).
 - iii. Pairing of irradiated versus un-irradiated flies and data collection on fecundity and hatchability (Oct-Dec 2024).
 - iv. Preparation of bait formulations (Aug-Sept 2024).
 - v. Installation of traps and field comparison of bait mixtures (Sept-Nov 2024).
 - vi. Preparation of fruit juice enriched proteinaceous baits (Mar-Apr 2025)
 - vii. Installation of traps and data collection (May-Jun 2025)
- b. Experimental material of the Project:
Rearing cages, tri-methylamine, casein, protein hydrolysate, methyl eugenol, sugar, fruits, traps, sieve etc.
- c. Expected tangible outcome of the project
- i. Determination of most suitable radiation dose for sterility induction.
 - ii. Identification of the optimal ratio of Tri-methylamine with selected bait mixtures for fruit fly attraction

PPD-5-2

1. Project Title: Investigating the effect of gamma irradiation in the production of pest-free commodities for trade promotion in Pakistan and elsewhere
2. Funding Source Type: IAEA
3. Principal Investigator: Dr. Muhammad Hamayoon Khan, PS
4. Team members (Scientists & Staff): Mr. Muhammad Salman, SS, Mr. Fazle Rahim, PSA and Mr. Muhammad Afaq, RA
5. Project Objectives: Use of gamma irradiation as a phytosanitary treatment for the control of cotton mealy bug *Phenacoccus solenopsis*, chickpea pod borer *Helicoverpa armigera*, and *H. zea*.
6. Background and Justification: Global trade in agricultural commodities has led to the spread of exotic pests, causing significant agricultural losses. To mitigate this, the World Trade Organization (WTO) enforces strict quarantine restrictions. Phytosanitary irradiation (PI) treatment has proven effective in controlling pests, and killing pathogens, and is environmentally friendly with no residue risks.
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - ii. A chickpea flour-based artificial diet was developed and found as the most suitable diet for laboratory rearing of chickpea pod borer, *H. armigera*.
 - i. A dose of 250 Gy was found to inhibit egg hatching and development of larval stages of chickpea pod borer *H. armigera*

- a. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

9. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges	10,000/-
2.	Total laborer charges (both from project & NIFA) Salary of Research Assistant	270,000/-
3.	Total POL charges	7857/-

10. Income Generation (Rs): NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Sowing of chickpeas (Nov–Dec)
- ii. Culturing of *H. armigera* in lab. (Mar-Apr, 2025)
- iii. Radio-tolerance study of lab. versus field population of *H. armigera* (Apr-Jun, 2025)
- iv. Collection and evaluation of suitable packing materials (Mar–Apr, 2025)
- v. Evaluating the efficacy of Radiation-Treated packing materials for *H. armigera* (Apr-Jun, 2025).
- vi. Lab rearing of *H. zea* (Apr– May, 2025).
- vii. Effect of irradiation doses on the metamorphic inhibition of *H. zea* (Apr-Jun, 2025).
- viii. Lab rearing of Mealybug (Sept-Oct, 2024) by Mr. Muhammad Salman, SS
- ix. Radio-Tolerance in laboratory-reared versus field-collected mealybugs (Sept–Nov, 2024) by Mr. Muhammad Salman, SS
- x. Collection and evaluation of packing materials (Dec–Jan, 2024/2025) by Mr. Muhammad Salman, SS
- xi. Evaluating the efficacy of Radiation-Treated packing materials for mealybug control (Feb-May, 2025) by Mr. Muhammad Salman, SS
- xii. Gamma radiation effect on the developmental stages of cotton mealybug (Apr-Jun) by Mr. Muhammad Salman, SS

b. Experimental material of the Project:

Diet ingredients, cages, camel hair brush, glassware, packing materials, vegetables/maize cobs, etc.

c. Expected tangible outcome of the project:

- i. Identification of the most effective radiation doses for control of mentioned insects.

- ii. Identification of the most effective radiation-treated packing materials for efficient protection of commodities

PPD-5-3

1. Project Title: Exploring efficacy and potential of botanicals against fruit fly in the context of Integrated Pest Management (IPM)
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Muhammad Salman, SS
4. Team members (Scientists & Staff): Dr. Muhammad Hamayoon Khan, PS & Mr. Fazle Raheem, PSA
5. Project Objectives: To identify and select suitable botanical compounds with insecticidal properties against fruit flies.
6. Background and Justification: The use of botanicals offers an eco-friendly alternative to synthetic insecticides, minimizing environmental harm and reducing pesticide residues on crops. Botanicals provide a sustainable solution for controlling fruit fly population and their integration into IPM enhances the overall fruit fly control strategy, promoting biodiversity and long-term pest management while lowering chemical dependence.
7. Summary of last year's research Work:
 - a. Tangible research work findings during 2023-24:
 - i. Our studies on adult diets documented those flies fed on solid diets exhibited more significant growth and development of *Bactrocera dorsalis* compared to those fed on liquid diets.
 - ii. Yeast diet resulted in the longest adult duration for *B. dorsalis*, with up to 99 days (solid) and 81 days (liquid), and produced the highest number of pupae (701) at 1:1 concentration. Conversely, the Casein diet led to the shortest adult duration, with 49 days (solid) and 32 days (liquid), and the lowest number of pupae (283) at 1:3 concentrations.
 - iii. In the botanicals study, Bakayen had the highest percent non-preference (49.8%) for peach fruit flies while Neem had the lowest at 37.6%. Garlic and Tobacco showed intermediate non-preference values of 43.3% and 42.6%, respectively.
 - iv. In pupal mortality, Bakayen resulted in the highest values (73.3%) and longest pupal duration (7.6 days). The control group had the lowest pupal mortality (6%) and shortest pupal duration (4 days).
 - v. The Adult mortality showed the highest rate (50%) for Bakayen having intermediate longevity (8.67 days), with a moderate number of recovered pupae (21.6). In contrast, the control group had the lowest mortality rate (15%), the longest longevity (32.6 days), and the highest number of recovered pupae (60.6).

- b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year's experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges	5000/-
2.	Total laborer charges	NIL
3.	Total POL charges	NIL

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Collection of infested fruit & vegetable samples for pupal recovery of fruit flies (August – October, 2024).
- ii. Rearing and maintenance of laboratory colonies of three fruit fly species (August, 2024 – June, 2025).
- iii. Collection of botanicals and preparation of extracts (February, 2025 – May, 2025).
- iv. Laboratory Bioassays of botanicals against *Bactrocera dorsalis* and *Bactrocera cucurbitae* (February, 2025 – May, 2025).
- v. Data synthesis, compilation, analysis and report writing (May – July, 2025).

b. Experimental material of the Project:

Infested fruits, pupal containers, adult cages, protein, sugar, botanical extracts etc.

c. Expected tangible outcome of the project:

A stable laboratory culture of fruit flies for R& D and identification of effective botanicals for fruit fly management& product development.

SOIL & ENVIRONMENTAL SCIENCES DIVISION (S&ESD)**S&ESD 1: PLANT NUTRITION GROUP****S&ESD-1-1**

1. Project Title: Development of low-cost liquid fertilizer and its application as foliar tonic for improving crop yield
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Syed Azam Shah, DCS
4. Team members (Scientists & Staff): Mr. Pervez Khan, PS, Mr. Yasir Anwar, PS, and Mr. Adeel Khattak, SA-1
5. Project Objectives: To develop a low-cost liquid fertilizer for foliar application of nutrients on crops to improve yields and fertilizer use efficiency
6. Background and Justification:

Pakistan wastes 36 million tons of food annually, accounting for nearly 40% of the country's total food production. Onion, a crucial vegetable crop, is a significant contributor to this waste. Onion peels are rich in potassium (0.104%), calcium (0.024%) and phosphorus (0.01%), and can be used as natural fertilizers, strengthening plants and preventing leaf discoloration. This project aims to evaluate the effects of onion peel juice on crop growth.
7. Summary of last year research Work: New project
 - a. Tangible research work findings during 2023-24: N.A
 - b. Patent/ Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year experiment: N.A
9. Income Generation (Rs.): NIL
10. Detail of ongoing funded research project(s) as PI only during 2023-24: NIL
12. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. Preparation of liquid extract and its analysis, soil analysis of experimental plot (November 2024)
 - ii. sowing of crop and application of mineral fertilizers. (December 2024)
 - iii. Application of foliar extract at different growth stages, agronomic data collection till crop harvest (December 2024 - March 2025)
 - iv. Chemical analysis of crop samples and straw samples for N, P, K (June - July 2025)
 - v. Data analysis and report writing (August 2025)
 - b. Experimental material/ brief summary of the project:

Seed of crop, plastic pots, onion peels, fertilizers, chemicals for lab analysis for N, P, K

c. Expected tangible outcome of the project:

Development of suitable and economical organic fertilizer for enhancing seed yield in crops/ vegetables

S&ESD-1-2

1. Project Title: Bio fortification of zinc (Zn) in wheat for balanced human nutrition
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Shahzada Asif Ali, SS / Mr. Parvez Khan, PS
4. Team members (Scientists & Staff): N.A
5. Project Objectives: To alleviate the nutrients (Zn) malnutrition by exploiting the genetic diversity of wheat genotypes for efficient utilization of micronutrients from less fertile soils for high yield & quality
6. Background and Justification:

In Pakistan, zinc (Zn) deficiency is an emerging health problem as about 20% of the population is Zn deficient. Zn contents in staple food (wheat) are very low, and inadequate information available on the subject, cultivation of highly susceptible wheat genotypes/cultivars to Zn deficiency may aggravate the situation so, there is a dire need to select Zn dense wheat genotypes to address the Zn malnutrition on sustainable basis.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

- i. Wheat genotype CTHRN-19101 and CTES-107 produced maximum biomass and higher Zn-efficiency at Zn deficient level (2 pM) and has been categorized as Zn-efficient
- ii. Wheat genotype CIB-5 and CT-18062 was ranked as Zn-inefficient as it produced the minimum quantity of biomass at 2 pM.
- iii. The genotype CTHRN-19101 and CTES-107 absorbed higher Zn contents at Zn deficient level whereas CIB-5 and CT-18062 had minimum Zn concentration

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment:

S. #	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	6,000/-
2.	Total laborer charges (both from project & NIFA)	5,000/-
3.	Total POL charges	-

9. Income Generation (Rs): NIL

10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

- a. Experimental activities at field/ laboratory:
 - i. Hydroponics study under glass-house to identify Zn-efficient wheat genotypes (September 2024 - January 2025)
 - ii. Establishment of field trial to validate the performance of Zn-efficient and Zn-inefficient wheat genotypes identified during last year hydroponics study (October 2024)
 - iii. Execution of field experiment (October 2024-May 2025)
 - iv. Harvesting of crop and post-harvest lab analysis (May 2025-July 2025)
 - v. Data analysis and report writing (August, 2025)
- b. Experimental material/ brief summary of the project:

Wheat seed of advance lines, chemicals for chelate-buffered nutrient solution, fertilizers (Urea, SSP, SOP, ZnSO₄), hydroponic system, thermopore sheets, glassware, etc.
- c. Expected tangible outcome of the project:

Identification of zinc efficient genotypes

S&ESD-1-3

1. Project Title: Mitigating the impact of Greenhouse Gases (GHGs) through irradiation
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Yasir Anwar, PS / Dr. Amir Raza, PS
4. Team members (Scientists & Staff): N.A
5. Project Objectives:
 - i. Development of appropriate technology to convert GHGs into simpler compounds or to transform them into less harmful substances.
 - ii. Development of innovative materials that can capture and convert GHGs into valuable products or stable storage.
 - iii. Development of materials and methods to support biological processes for the removal of GHGs.
6. Background and Justification:

GHGs such as carbon dioxide and methane play a significant role in the greenhouse effect, contributing to global warming and consequential shifts in earth's climate. The resulting rise in temperature leads to various impacts, including altered weather patterns, rising sea levels, extreme weather events, and disturbances to ecosystems. Furthermore, the presence of certain greenhouse gases combined with other pollutants can compromise air quality, posing health risks to humans, animals and the environment. In the pursuit of environmental sustainability and materials innovation, radiation technology emerges as a potent

tool. Leveraging ionizing radiation, it becomes possible to instigate chemical reactions that break down GHGs into simpler, less harmful compounds or transform them into benign substances. This radiation-based approach holds promise for the development of materials integral to Carbon Capture and Utilization processes. These materials facilitate the capture and conversion of carbon dioxide emissions from industrial sources, turning them into valuable products or ensuring stable storage.

7. Summary of last year research Work: N.A
 - a. Tangible research work findings during 2023-24: N.A
 - b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year experiment: N.A
9. Income Generation (Rs.): N.A
10. Detail of ongoing funded research project(s) as PI only during 2023-24: N.A
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. Establishing protocols for analysis of CO₂, CH₄, N₂O and SF₆ (October, 2024-February, 2025)
 - ii. Establishing protocols for irradiation of GHGs (March-April, 2025)
 - iii. Irradiation of GHGs with Co-60 irradiator at different dose levels & performing the analysis with GC-MS (May-August, 2025)
 - iv. Compilation of obtained results and report writing (September, 2025)
 - b. Experimental material/ brief summary of the project:
CO₂, CH₄, N₂O & SF₆ Gases, Gas sampling container, He Gas Cylinder, GC-MS, Co-60 irradiator
 - c. Expected tangible outcome of the project:
Conversion of GHGs with the help of radiation technology into simple or less harmful substances

S&ESD 2: SOIL BIOLOGY AND BIOCHEMISTRY GROUP**S&ESD-2-1**

1. Project Title: Monitoring the long-term impact of conversion to organic farming systems
2. Funding Source Type: PAEC
3. Principal Investigator: Dr. Amir Raza, PS
4. Team members (Scientists & Staff): Mr. Shahzada Asif Ali, SS, Dr. Haroon Shahzad, JS & Mr. Mushtaq Ali, Research Associate.
5. Project Objectives:
 - a. To maintain soil fertility through organic farming practices.
 - b. To develop a package of production technology for organic wheat and potato production.

6. Background and Justification:

The intensive use of chemical fertilizers has introduced problems of pollution, land degradation and yield stagnancy. Sustainable production from our soils is at high risk under current erratic impact of changing climate that can have serious repercussions for national food security. Situation demands to find suitable alternatives to deal with the twin menace of climate change and continually diminishing soil fertility. Organic farming system offers one alternative to conventional/ chemical farming system. The systematic research on organic farming is still lacking in Pakistan. This research gap needs to be bridged through conducting long term experiments on comparative assessment of soil fertility and crop yield under conventional and organic farming systems. The current project attempts to bridge this research gap.

7. Summary of last year research Work:

- a. Tangible research work findings during 2023-24:
 - i. Differences between organic and chemical systems of crop production for wheat & potato yield and other parameters under study were found non-significant. Relatively higher crops yields were recorded under chemical farming system as compared to organically managed systems.
 - ii. Soils under organic farming system maintained better fertility status as compared to chemical farming system.
 - b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
8. Expenditure on last year experiment:

S.#	Purpose	Expenditures (Rs)
1.	Total consumable charges (no need for detail)	4,500/-
2.	Total laborer charges (both from project & NIFA)	12,000/-
3.	Total POL charges	7,858/-

9. Income Generation (Rs.):

Activity	Total sale	*Expenditure	Profit
Sale of compost	37,600	12,032	25,568

10. Detail of ongoing funded research project(s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

- i. Sowing of experiment on potato and wheat crops (October-November, 2024)
- ii. Maintenance of field experiment, harvesting of potato experiment, data collection etc. (October 2024-April 2025)
- iii. Harvesting of wheat experiment, soil and plant sampling (May, 2025)
- iv. Analytical work (May-June, 2025)
- v. Sowing and agronomic management of Kharif season crops, green manuring of sesbania, report writing (July-September, 2025)

b. Experimental material/ brief summary of the project:

Seeds (potato and wheat), fertilizers (Urea, SSP, SOP), compost, weedicide (tilt, buctril-M & full control), chemicals for soil and plant analyses, glassware, brown paper bags, plastic bags, etc.

c. Expected tangible outcome of the project:

Development of technology packages for organic wheat and potato production

S&ESD-2-2

1. Project Title: Enrichment of agro-waste compost for nitrogen (N) and phosphorus (P) contents
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Zahid Ali, PS
4. Team members (Scientists & Staff): N.A
5. Project Objectives:
 - a. To enhance N and P contents in agro-waste compost using multiple resources
 - b. To test efficacy of N and P enriched compost on the performance of leafy vegetables
6. Background and Justification:

Compost (a slow-release organic fertilizer) may serve as partial substitute for intensively used chemical fertilizers, leading to sustainable crop production. Compost products available in local market are mostly developed from urban/municipal wastes and may contain toxic elements (heavy metals) and have low contents of essential plant nutrients (about 1-2% nitrogen and 0.3-0.5%

phosphorus). The current project aims at enhancing the nutritive value of existing agro-waste composts.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

Among the various formulations used for preparation of enriched agro-waste Compost, maximum N (1.4%) was recorded when agro-waste was enriched with animal manure, rock phosphate & mushroom spent, while maximum P (1.9%) was found when agro-waste was enriched with animal manure, rock phosphate, filter cake, poultry manure & green soil. The maximum microbial load (1.4×10^7 cfu) was found in the compost enriched with animal manure, rock phosphate and filter cake.

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment: NIL

9. Income Generation (Rs.): NIL

10. Detail of ongoing funded research project(s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

i. Analysis of nutrients rich sources of plant nutrition (October-December, 2024)

ii. Establishment of composting trial (January-June, 2025)

iii. Analysis of mature composts (July-August, 2025)

iv. Data analysis and report writing (September, 2025)

b. Experimental material/ brief summary of the project:

Agro-waste materials, indigenous nutrient rich sources of plant nutrition (banana peels, onion peels, fruit & vegetables market waste, etc.), plastic sheets, chemicals, glassware, etc.

c. Expected tangible outcome of the project:

Development of N and P enriched slow-release organic fertilizer (compost)

S&ESD-2-3

1. Project Title: Enrichment of compost tea for its nutritive value:

2. Funding Source Type: PAEC

3. Principal Investigator: Mr. Shahzada Asif Ali, SS

4. Team members (Scientists & Staff): N.A

5. Project Objectives:

a. To enrich compost tea through multiple sources of plant nutrition

b. To test efficacy of enriched compost tea for improving yield of vegetables

6. Background and Justification:

Current era emphasizing sustainability does not permit excessive chemical input and focuses on conservation of land & environment. The situation demands to partly shift towards organic production that is constrained by non-availability of good quality organic fertilizer products. One viable option would be to use compost tea (liquid extracts of compost) but the nutrient contents of indigenously available compost teas are very low. The current project will address this issue by developing nitrogen enriched compost tea by exploiting various potential indigenously available natural sources of plant nutrition.

7. Summary of last year research Work:

a. Tangible research work findings during 2023-24:

i. Enrichment study of compost tea revealed that highest value of nitrogen and phosphorus were recorded in compost teas enriched by using MIK Vermicompost (742 ppm) and Green Garden Compost (685 ppm), respectively.

ii. The findings of a comparative study conducted on potato crop under field conditions depicted that Rhizobacterial application gave comparatively higher tuber yield in organically managed plot than chemically managed plot (10.13 and 9.29 t ha⁻¹, respectively) and it was followed by the application of compost tea (9.83 and 8.97 t ha⁻¹, respectively).

b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL

8. Expenditure on last year experiment: NIL

9. Income Generation (Rs.): NIL

10. Detail of ongoing funded research project(s) as PI only during 2023-24: NIL

11. Planned research work for the year 2024-25:

a. Experimental activities at field/ laboratory:

i. Identification of nutrients dense materials (October-December, 2024)

ii. Development of various formulations of enriched compost tea (January-March, 2025)

iii. Analysis of enriched compost tea (April-May, 2025)

iv. Efficacy trial on enriched compost tea (May-July, 2025)

v. Data analysis and Report writing (August-September, 2025)

b. Experimental material/ brief summary of the project:

Nutrients dense raw materials (dried powder of fruit & vegetables market waste, powdered rock phosphate, humic acid, etc.), jute bags, plastic buckets, chemicals for nutrients analysis, glassware, etc.

c. Expected tangible outcome of the project:

Baseline data will be generated, that may lead towards the development of liquid fertilizer product.

S&ESD-2-4

2. Project Title: Isolation, screening and biochemical characterization of different rhizobacterial strains for the development of effective bacterial product
3. Funding Source Type: PAEC
4. Principal Investigator: Dr. Haroon Shahzad, JS
5. Team members (Scientists & Staff): N.A
6. Project Objectives:
 - a. Screening of isolated strains for motility, ammonia and HCN production
 - b. To characterize strains for enzymes (Catalase, Protease, Amylase, Lipase and cellulase) production
7. Background and Justification:

Rhizobacteria are rhizosphere colonizing microbes that have capability to fix atmospheric nitrogen, solubilize phosphorus and potassium and release plant growth regulating compounds like auxins. They are natural contributors towards soil fertility therefore they are also environmentally safe. The existing products have capacity to address one or two fertility issues. This project will be used to make consortium of different types of rhizobacteria after compatibility analysis to result in a concrete product to resolve soil fertility issues.
8. Summary of last year research Work:
 - a. Tangible research work findings during 2023-24:
 - i. The bacterial strains isolated from berseem had shown significantly ($P \leq 0.05$) higher viable counts and optical density while IAA production was highest of strain isolated from compost tea.
 - ii. Acid production was positive and P-solubilization was negative in all strains.
 - iii. Strains isolated from wheat and potato rhizosphere were gram positive while others were gram negative.
 - b. Patent/Lab Accreditation/Product certification/Licensing/Commercialization by authorized department during 2023-24: NIL
9. Expenditure on last year experiment: NIL
9. Income Generation (Rs.): NIL
10. Detail of ongoing funded research project (s) as PI only during 2023-24: NIL
11. Planned research work for the year 2024-25:
 - a. Experimental activities at field/ laboratory:
 - i. Motility Testing (October, 2024) / Ammonia Production Test (November-December, 2024) and

- ii. HCN Production Test (January-February, 2025) / Catalase Test (March, 2025)
 - iii. Protease Test (April-May, 2025) / Amylase Test (June, 2025) and Lipase Test (July, 2025) / Cellulase Test (August-September, 2025) and Statistical data analysis and Report writing (September, 2025)
- b. Experimental material/ brief summary of the project:
- Chemicals (bromothymol blue, gram stain, etc.) glassware (petri plates, test tubes, flask, etc.), growth media (agar, peptone, yeast extract, dextrose, etc.)
- c. Expected tangible outcome of the project:
- Selection of better performing strains that may lead towards product development.

NIFA Annual Research Programs Evaluation & Planning Committee

Recommendations/Guidelines

NIFA Annual Research Program Evaluation and Planning Meeting-2024 (ARPEPM-2024) of the Plant Breeding & Genetics Division, Plant Protection Division, Food and Nutrition Division, and Soil & Environmental Division were held on September 12, 13, 19 & 20, 2024, respectively. The Annual Research Program Evaluation & Planning Committee (ARPEPC) was comprised on;

1. Dr. Gul Sanat Shah, DCS, Director NIFA (Chairperson)
2. Dr. Muhammad Imtiaz, DCS, Head SE &SD (Member)
3. Dr. Syed Jawed Ahmad Shah, DCS, Head PPD (Member)
4. Dr. Maazullah Khan, DCE, Head FND (Member)
5. Dr. Roshan Zamir, PS, Head PB & GD (Member)
6. Dr. Muhammad Amin, PS, Manager ORIC (Convener)

Convener ARPEPC, Dr. Muhammad Amin, PS/Manager ORIC welcomed all members of ARPEPC and scientists of each research division on their respective day.

Dr. Gul Sanat Shah, Director NIFA, in his opening remarks, briefed and highlighted the following general important guidelines to the scientists of each research division regarding the scope/domain of ARPEPC and improvement of Research and Development (R&D) activities under the prevailing financial situation;

General Recommendations/Guidelines

1. The NIFA Annual Research Programs Evaluation & Planning Meeting (ARPEPM-2024) will cover the evaluation of results/findings achieved during 2023-24 and planning for 2024-25.
2. The ARPEP forum is purely meant for the evaluation of last year's research achievements/findings and planning of research program for the next year. Thus, the ARPEP committee domain is to suggest improvement in the provided information by each scientist regarding his research program. The committee will not entertain complaints, shortage of man-power, equipment, supplies, trainings, visits etc. Such issues can be discussed with respective HoD and Director for possible solution.
3. Development of crop varieties, lab accreditations, or product certifications under process/consideration by relevant authorized departments in the country will not be considered as achievement during 2023-24 unless it has been approved by the concerned forum. All plant breeders shall follow NIFA policy for developing crops varieties and breeders name circulated vide circular no. NIF-H-06-249 (02) dated 02-05-2024 and provide check list for approval of submission of proposal of candidate crop variety to Variety Evaluation Committee (VEC) or Provincial Seed Council (PSC) circulated vide circular no. NIF-H-06-249 (02) dated 11-06-2024. The candidate variety proposal will not be forwarded/recommended by Head

PBGD to Director for onward submission to VEC and PSC without completion of above mentioned checklist.

4. Tangible findings refer to solid conclusions, achievements, finished products etc., from the last year's experiment. These should not include procedure, activities or routine data results. Best performing advanced line (s) in KPYT, AYT and NUYT or contributing advanced line (s) in these trials or DUS etc., may be considered as tangible findings. "Nil" will be the proper word if there are no tangible findings.
5. Papers published after proper approval from PAEC, HQs. may be included in the list. Approved RD-1 form is obligatory for publishing research work conducted at NIFA or related to its research programs in scientific Journal. Legal action will be recommended against scientists who publish research papers without proper approval through RD-1 form. Urdu/English articles in Zarat Nama, Newspapers and radio talks may also be included.
6. In case the core and funded projects are of the same nature with similar objectives, the PI may write/present them as one project. If both have different objectives, each one should have a separate write-up and presentation.
7. HoDs will present last year's main tangible findings of the division i.e., ongoing funded projects, published research papers, events conducted and trainings attended.
8. Generated income through respective scientific activity will only cover the sale of product (s) especially developed for income generation (NIFA Dengue Guard, Rapid test Kits and squashes etc) or analytical services (gemstone irradiation, water testing, soil testing and brassica oil quality testing through NIR etc). Experimental produce like quality seed, grain and sale of vegetables will not be reported as income generation. This is farm produce and will be reported under NIFA farm not as income generation.
9. HoDs will also present their group presentation as per the provided format.
10. Tangible achievements/results provided for the ARPEPM meeting's write up and presentation should be statistically analyzed. All scientists may consult Dr. Muhammad Amin, Pr. Scientist /Statistician, for suitable experiment design and statistical analysis. Scientists can get training for their specific statistical design/analysis by submitting request through their respective HoDs.
11. All scientists will provide information (write up and presentation) to their respective HoD in soft and cc to Director and Convener of the committee (Dr. Muhammad Amin). The HoD will review/refine and submit the compiled final report (write up/presentation) to the convener of the ARPEP committee within the specified time and cc to Director. The convener of the ARPEP meeting will compile the report and prepare copies for each member. Respective HoD will ensure format and errors free document of ARPEP of his research division.
12. Earlier outlines of all ARPEP meetings shall be considered valid till cancelled/amended in written and approved by the Director.

13. Each scientist including Head of the Divisions may have funded research project and publish a research paper in peer reviewed scientific journal each year.

Following the Director's opening remarks, respective Head of the Division (HoD) and scientists within the division shared results/outcomes of the previous year (2023-24) and outlined their research plans for the forthcoming year (2024-25). The division wise ARPEPM-2024 recommendations/guidelines are reported below;

FOOD AND NUTRITION DIVISION (FND) RECOMMENDATIONS/GUIDELINES

The ARPEPM-2024 of FND was held on September 19, 2024. The divisional recommendations/guidelines are as below;

FOOD ENGINEERING AND IRRADIATION GROUP**Dr. Maazullah Khan, DCE**

Dr. Maazullah Khan, DCE/Head FND detailed the composition of Food and Nutrition Division (FND) and its last year's notable achievements. He welcomed the newly promoted members of FND to the officer's club and wished them good luck for their future endeavors. Afterwards, he explained his R&D work carried out on the design & development of indirect hybrid solar dryer at NIFA under PARC funded project. Committee also suggested to include a control/reference sample/material during experimentation for comparative studies.

Mr. Alamgeer Khan, PS

Mr. Alamgeer Khan, PS shared his R&D work under his IAEA funded CRP-24289. The committee inquired about the progress made with ATCOP about data evaluation and validation. The Committee showed concerns about privacy of data while conducting analysis from third party and instructed Mr. Alamgeer to ensure safety of data.

Mr. Muhammad Asim Irshad, JS

Mr. Muhammad Asim Irshad, JS presented data on his last years significant achievements on preparation of gluten free muffins. The committee advised him to remove alphabets from non-significant values during statistical analysis. Committee also enquired about the details of issue about cakes raised by ATCOP and suggested him to contact ATCOP to get the details of the customer who raised the issue about cakes and contact him directly for complete details. Mr. Asim was advised to include data about celiac patients in Pakistan to make his research more viable.

Mr. Waseem Jan, ATO

Mr. Waseem Jan, ATO has been promoted this year and did not have any research data from last year. He presented his R & D plan for the next year on value addition of tomatoes. However, he has revised his research plan on the recommendation of the committee and after consultation with head FND and Dr. Zahid Mehmood, PS, .to value addition of garlic through solar drying.

FOOD & ENVIRONMENTAL SAFETY GROUP**Dr. Muhammad Ibrahim, PS**

Dr. Muhammad Ibrahim, PS presented his research work on Pearl Oyster Yield Enhancement and Commercialization, and Pharmacological Evaluation of Ganoderma Mushroom. The, ARPEP committee suggested him to focus on development of low-cost substrate to reduce production cost.

Mr. Khurshid Ahmad, SS

Mr. Khurshid Ahmad, SS presented his findings of last year's R & D on standardization of HPLC method for honey testing. Committee suggested him to run a standard/reference sample along with unknown samples during conduction of various analyses of honey and discuss it with Dr. Muhammad Imtiaz.

Mr. Nisar Ahmad, ARO

Mr. Nisar Ahmad, ARO informed the committee about his research work on development of method for SO₂ determination. The committee advised him to submit a project for possible funding for procurement of Rankin apparatus, conventionally used for SO₂ determination. They also advised Mr. Nisar to discuss the statistical analysis with Dr. Amin and try to publish his findings in a well reputed journal.

Mr. Arshad Ali, ARO

Mr. Arshad Ali, ARO highlighted his results from his last year's study on honey testing.

The ARPEP committee suggested him to specifically mention the locations from where he & Mr. Khurshid will collect the honey samples.

FOOD NUTRITION GROUP

Dr. Zahid Mehmood, PS

Dr. Zahid Mehmood, PS presented his research work on NIFA iodine and POV RTKs and correspondence with NI for release of project funds for design, fabrication testing of VITAMETER. The committee advised him to discuss the funds issue with Head LAO and Director NIFA and clearly mention the status of Mr. Asif Murad in the project team.

Mr. Tauqeer Ahmad, JS

Mr. Tauqeer Ahmad, JS presented his findings about development of RTK for detection of zinc in wheat flour. He also explained his results on the work carried out for the development of another RTK for detection of adulterants in red chilli powder and turmeric powder.

Mr. Aurang Zeb Khan, ARO

Mr. Aurangzeb Khan, ARO explained his ARP work on indigenous production of KIO₃. The committee advised him to add chemical reaction to attain the said product and further explore the reaction parameters e.g. time by reviewing literature to increase the yield & purity of final product

Dr. Syed Jawad Ahmad shah, DCS on behalf of ARPEP committee; appreciated the R & D efforts and presentations of FND scientists in his concluding remarks. He also highlighted the significance of publications and ended the meeting with noble wishes for all the attendees

PLANT BREEDING AND GENETICS DIVISION (PBGD) RECOMMENDATIONS / GUIDELINES

The ARPE&PM-2024 of PBGD was held on September 12, 2024. The divisional recommendations/guidelines are as below;

HORTICULTURE GROUP

Dr. Roshan Zamir, DCS/Head PBGD

Dr. Roshan Zamir presented an over-view of the PB & GD and briefed the house regarding PB&GD's salient achievements i.e. recommendation of mungbean candidate variety 'NIFA Mung-24' from VEC in a meeting held at PARC, Islamabad on 16-04-2024. He also informed the house about inclusion of pulses, wheat, oil seed brassica and okra candidate lines in NUYT/DUS in 2023-24. Dr. Roshan Zamir presented previous year's results of his research project 'Improvement of plum for yield and quality through induced mutations and introduction'. Afterwards he shared his 2024-25 proposed research activities regarding above-mentioned research project.

Mr. Shahid Akbar Khalil, PS

Mr. Shahid A. Khalil shared results of 2023-24 R&D work and presented 2024-25 research plan regarding his proposed research activities of his core entitled "Improvement of peaches for yield and quality" as well as PSF-funded project entitled "Sustainable approaches for effective control of peach stone replant disorders". Committee proposed to mention specific date/period of fruiting/harvest instead of saying that Plawhite-5 is ready for harvest 13-15 days before the Early Grand. He was suggested to focus on yield along with quality and earliness because without higher yield the quality and earliness may not help to approve variety. He was also suggested to introduce mustard cake as an effective control of peach stone replant disorders among nursery growers in Tarnab area particularly who are working or has been worked at NIFA (Mr. Aslam Khan and Aurungzeb etc). He was further suggested to work out the cost benefit ratio of mustard cake utilization for the control of peach stone replant disorders. Mr. Shahid Akber may prepare Urdu pamphlet in soft, article for Zarat Nama and Radio talks about mustard cake utilization for the control of peach stone replant disorders.

OILSEED BRASSICA GROUP

Mr. Hafiz Munir Ahmad, PS

Mr. Hafiz Munir Ahmad presented/shared results of 2023-24 R&D work on his research project titled 'Genetic improvement of oilseed brassicas through induced mutations' and also shared his 2024-25 research plan for the mentioned project. Mr. Hafiz Munir Ahmad informed the house that one of the group's mustard candidate line 'NIFA Raya T-24' was to be submitted to oilseed VEC meeting to be held at PARC, Islamabad. ARPEPC advised Mr. Hafiz Munir Ahmad to focus on hybrids development in oilseed brassicas because of PAEC special funding for it. He was also reminded to pay attention to register oil seed brassica approved mutants varieties in IAEA mutant varieties database. He was further advised to approve his oil seed brassica varieties

in other provinces particularly in Sind where rapeseed varieties seed demand is more compare to KP.

WHEAT GROUP

Dr. Muhammad Irfaq Khan, PS

Dr. Muhammad Irfaq Khan shared results of his 2023-24 research work titled 'Evaluating exotic and new wheat genotypes for yield and related traits through mutation, hybridization and multi-location trials. He also informed the house about better performance of one of the group's wheat candidate line 'CT18062' in NUYT. He also briefed the house about inclusion of the group's five candidate lines in DUS trial. Afterwards, he shared 2024-25 proposed research plan. ARPEPC suggested him pay attention to get funded project (s) other than PAEC as well research papers. He should also focus on hybrids development in wheat because of PAEC special funding for it. Wheat variety through cross breeding is also long awaited liability on Dr. Muhammad Irfaq Khan.

Dr. Farooq-i-Azam, PS

Dr. Farooq-i-Azam presented results of 2023-24 R&D work titled 'wheat improvement for high yield and stress tolerance, and shared 2024-25 planned research work. He was suggested by ARPEPC to avoid the use of term drought tolerance/rainfed R&D in his program.

Dr. Salman Ahmad, PS

Dr. Salman Ahmad talked about results of 2023-24 experiments on 'Screening and evaluation of exotic/local wheat nurseries and trials' and also presented 2024-25 R&D plan regarding above-mentioned research project. ARPEPC advised him not to conduct wheat late-sowing/planting experiments for the purpose of variety development. He was further directed to use a range of physiological parameters for stress tolerance studies.

Dr. Akhtar Ali, SS

Dr. Akhtar Ali briefed the house about results of previous year's experiments on 'wheat breeding for disease resistance and moisture stress, and presented his 2024-25 R&D plan regarding his intended research project. The committee suggested him pay serious attention to get funded research project and publish research papers.

PULSES GROUP

Dr. Iqbal Saeed, PS

Dr. Iqbal Saeed talked about 2023-24 results his research experiments titled 'Breeding high yielding and large-seeded mungbean genotypes through induced mutation and cross-breeding techniques'. He also informed the house regarding recommendation of a green-seeded mungbean candidate variety 'NIFA Mung-24' by the VEC in a meeting held at PARC, Islamabad on 16-04-2024, and carrying-out DUS of two candidate lines. Afterwards, he shared his 2024-25 planned R&D activities on regarding above-mentioned research project. ARPEPC reminded him to pay attention to register mungbean approved mutant varieties in IAEA mutant varieties database.

Mr. Shahzad Ahmad, JS

Mr. Shahzad Ahmad presented results of his research experiments conducted in 2023-24 on 'Breeding high yielding kidney bean genotypes through induced mutation and cross-breeding techniques'. He also informed the house about carrying-out DUS of a candidate line 'NKB-Kenya' during 2023-24. Later-on, he shared information about planned research activities in 2024-25 R&D for 'Breeding high yielding common bean genotypes through induced mutation and cross breeding techniques'. ARPEPC advised him to pay attention to get funded project (s) and learn skills related to hybrid development during his stay for Ph. D. studies in China.

VEGETABLES GROUP**Dr. Syed Tariq Shah, PS**

Dr. Syed Tariq Shah presented his 2023-24 R&D work regarding Pak-China Wheat Project titled 'Evaluation of exotic wheat germplasm received from CIMMYT/CIB, CAS, China' and okra research project titled 'breeding of okra high yielding genotypes development through induced mutation and breeding techniques'. He also informed the house about carrying-out of a candidate line 'NBL-1' during 2023-24. Afterwards, he shared his 2024-25 planned research activities. ARPEPC suggested Dr. S Tariq Shah that If Pak-China project release budget for next year then trials should be conducted. In case next cycle extension of the same project is possible then he may help breeders of the wheat program for submission of project. ARPEPC also advised him to focus on hybrids development in Okra because of PAEC special funding for it.

Dr. Muhammad Imtiaz, Head S&ESD concluded the session and said that the overall presentations of the plant breeding and genetics division were up to the standard. The slides quality was good and readable with informative text. The overall achievements including candidate variety(s) recommended by VEC, funded projects, publications and breeding material/advance lines developed for conversion into commercial varieties by individual scientist/ group were good. Dr. Muhammad Imtiaz emphasized on development of high yielding and disease resistance varieties with commercial potential for income generation. It is hoped that the suggestions given by ARPEP committee will improve breeding programs of the division.

PLANT PROTECTION DIVISION (PPD) RECOMMENDATIONS/GUIDELINES

The ARPEPM-2024 of the Plant Protection Division was held on 13-09-2024. The divisional recommendations/guidelines are as below;

PLANT PATHOLOGY GROUP**Dr. Syed Jawad Ahmad Shah, DCS**

Dr. Syed Jawad Ahmad Shah, Group Leader of Plant Pathology, DCS, and Head of PPD, delivered a comprehensive presentation highlighting the significant scientific achievements and tangible results of five research groups within the division. As the Plant Pathology group leader, Dr. Jawad Ahmad Shah emphasized key outcomes from the previous year's research and outlined future directions, focusing on the "Epidemiology of invasive and non-invasive wheat pathogens, identification of resistant germplasm, and effective chemical control strategies." The Director commended Dr. Jawad's presentation and directed all Research Heads to follow his example, particularly noting the inclusion of quantifiable achievements such as publication numbers, human resource development, radio talks, and training at both local and international levels.

During the session, the ARPEPC raised concerns about the unavailability of Tilt pesticide in the market. The Head of PPD explained that the high efficacy of Tilt against wheat rust had led to its shortage. Dr. Amin, PS and Convener of ARPEPC, also inquired about the high variation in disease surveillance data. In response, the Head of PPD clarified that such variations are inherent in biological experiments and suggested that PPD scientists consult Dr. Amin for statistical analysis guidance when needed.

BIO-CONTROL GROUP**Mr. Muhammad Zahid, DCS**

Mr. Muhammad Zahid, Deputy Chief Scientist and Group Leader, presented a summary of his research outcomes from the past year and outlined the research plan for 2024-25. He briefly discussed the "Integrated Pest Management (IPM) of the fruit worm, *Helicoverpa armigera* (Hub.), using the egg parasitoid *Trichogramma chilonis* (Ishii) and bio-pesticides in the okra crop." Following Mr. Zahid's presentation, the ARPEPC provided the following specific recommendations:

The ARPEPC provided several recommendations to Mr. Zahid regarding his research. They instructed him to include the percentage of infestation or the number of larvae per plant in the table related to the biological control of the fruit worm, along with the release dates of *Trichogramma*. He was also advised to publish papers on his research, specifically on the management of *Helicoverpa armigera*, and to submit a comprehensive report outlining challenges in the commercialization of Tricho-cards.

Mr. Usman Khalique, JS

Mr. Usman Khalique, Junior Scientist of the Bio-control Group, delivered a comprehensive presentation summarizing his research outcomes from the past year and outlining his future research plans under two key topics: "Eco-friendly management of tomato fruit worm in tomato crops and wheat aphids in wheat crops." The ARPEPC commended Mr. Usman for his effective data presentation and recommended the following actions: Mr. Usman was advised to thoroughly evaluate and select an appropriate carrier for his intended bio-pesticide product to maximize its efficacy, as the choice of carrier is critical in influencing the product's stability, delivery, and overall effectiveness, which ultimately determines its success in field applications. Additionally, the Head of PPD instructed Mr. Usman to assess the feasibility of utilizing entomopathogenic fungi as biological control agents against fruit flies and termites, contingent upon preliminary results demonstrating promising potential.

MEDICAL ENTOMOLOGY GROUP**Dr. Gul Zamin Khan, DCS**

Dr. Gul Zamin Khan, the Deputy Chief Scientist and leader of the Medical Entomology Group, presented the outcomes of his research and outlined future research plans through two titles: "development of parthenium based bio-pesticide and ovi-traps/ baits for the surveillance and management of deadly mosquitoes" and " Enhancing the capacity and the utilization of the Sterile Insect Technique (SIT) for Aedes mosquito control." Following his presentation, the ARPEPC made the following points:

Dr. Gul Zamin Khan was advised to specify the source or institution from which he obtained the nanoparticles and to detail any collaborations involved to clarify the nature of his work. The esteemed Director highlighted concerns regarding the availability of DEET (N,N-diethyl-meta-toluamide), a chemical used in NIFA's Dengue Guard. In response, Dr. Gul Zamin Khan noted that he has planned future research aimed at improving Dengue Guard by identifying an effective organic alternative to replace DEET, which could represent a significant breakthrough if successful. Additionally, the committee suggested that a local plant known as Tulsi may serve as a potential mosquito repellent and should be included in the trials for improving Dengue Guard. Finally, the Head of PPD requested that Dr. Gul Zamin Khan, in his capacity as the NCP of IAEA RAS, share details of his future work and any communications or correspondence conducted thus far with relevant stakeholders.

TERMITE MANAGEMENT GROUP**Dr. Misbah ul Haq, PS**

Dr. Misbah ul Haq, Principal Scientist and leader of the Termite Control Group, presented his research findings and outlined future research initiatives under two main topics: "Exploitation of Anti-Termite Potential of Local Plants for Subterranean Termite Management in Urban and Agricultural Settings" and "Hunting for Naturally Existing Tsl Mutation in Aedes aegypti and Ae. albopictus for Constructing a More Robust Genetic Sexing Strain (GSS) for the Sterile Insect Technique (SIT)." Following his presentation, the esteemed Director commended his innovative method of

demonstrating trail-following behavior in termite workers through a video. The ARPEPC inquired whether he had calculated the cost-benefit ratio of using clove, considering its high cost. In response, Dr. Misbah ul Haq noted that the pesticide Fipronil, which he used as the standard for termite control, is even more expensive than clove. During the discussion, ARPEPC recommended using a code to refer to the active ingredients of the organic termiticide under development, rather than disclosing the actual ingredients in reports and presentations, particularly when sharing information outside the institute in the future.

Mr. Muhammad Arfan, SS

Mr. Muhammad Arfan, Senior Scientist in the Termite Group, provided an overview of his results from the past year and outlined his plans under the title "Development of Local Attractive Bait Matrix and Toxin Delivery Foraging Stations for the Control of Subterranean Termite Species." The ARPEPC made the following recommendations: Specify the year and months in the planned activities, and consider involving the pesticide company interested in the commercialization of the intended product for future collaboration and potential business relationships.

FRUIT FLY MANAGEMENT GROUP

Dr. M. Hamayoon Khan, PS

Dr. M. Hamayoon Khan, Principal Scientist and leader of the Fruit Fly Group, presented a detailed overview of the results from the previous year and outlined future research plans under the titles "Integrated Management of Fruit Flies" and "Investigating the Effect of Gamma Irradiation in the Production of Pest-Free Commodities for Trade Promotion in Pakistan and beyond." Following the presentation, the ARPEPC provided the following specific instructions: Coded information should be used instead of specifying the actual ingredients for the fruit fly bait under development to maintain the confidentiality of the formulations and mitigate the risk of intellectual property theft during the research and development phase.

Muhammad Salman, SS

Mr. Muhammad Salman, Senior Scientist in the Fruit Fly Group, provided an overview of his research efforts from the previous year and presented his research plan for 2024-25 under the program "Exploring Efficacy and Potential of Botanicals against Fruit Flies in the Context of Integrated Pest Management (IPM)."

After the session, Dr. Maazullah Khan, Head FND commended the presentations delivered by the PPD team. He praised the substantial number of publications produced and the significant number of students supervised by PPD scientists. Additionally, he acknowledged the promising products currently under development within PPD and emphasized the importance of securing patents for these innovations to protect intellectual property and facilitate future commercialization.

SOIL & ENVIRONMENTAL SCIENCE DIVISION (S&ESD) RECOMMENDATIONS / GUIDELINES

The ARPEPM-2024 of the S&ESD was held on 20-09-2024. The divisional recommendations/guidelines are highlighted below:

PLANT NUTRITION GROUP

Dr. Muhammad Imtiaz, DCS/ Head, S&ESD

Dr. Muhammad Imtiaz, DCS/ Head S&ESD presented a brief overview of ongoing core and funded research projects undertaken by the scientists of the division along with the summary of human resources and publications. He provided an overview of the upgradation of S&ESD laboratories by equipping them with latest models of Atomic Absorption Spectrophotometer, Flame Photometer, Spectrophotometer, pH meter and EC meter. The committee lauded valuable scientific contributions of Dr. Muhammad Imtiaz, DCS and Mr. Parvez Khan, PS who are going to be retired in near future.

Mr. Parvez Khan, PS

Mr. Parvez Khan, PS presented work related to tunnel farming and zinc biofortification in wheat. Committee suggested that zinc (Zn) biofortification studies shall be included as an activity under the core project of relevant PBGD scientist along with the involvement of a scientist from S&ESD. Furthermore, screening for zinc efficiency shall be carried out by S&ESD, only if breeder provides the advanced lines to S&ESD. During the discussion on Zn-biofortification program carried out by Dr. Muhammad Imtiaz, Dr. Azam Shah started giving non-technical comments in humiliating manner by stating "Imtiaz, you have wasted twelve years in research that has no utilization". When he was asked to give technical arguments in this regard, he had no valid justification. In response to irrelevant interference of Dr. Azam Shah, Dr. Muhammad Imtiaz updated ARPEPC and entire forum that Zn-biofortification program was reviewed by Dr. Yousaf Zafar, an eminent scientist and the then DG (Agri & Bio) on 30-05-2012 (evidence available if desired) and approved by Member (Science). None of the committee members/directors has objected this program since its inception. The member of committee and Head PBGD also endorsed that it is need of the hour to divert our research efforts towards enhancement of quality through biofortification of major crops.

Regarding tunnel farming project, Mr. Parvez Khan informed the ARPEPC about the activities carried out during last year. He further told that now farmers have established tunnels and are even exporting vegetables. Currently, there is no R&D research gap relevant to the needs of vegetable growers of the area. He suggested to discontinue the tunnel R&D project at NIFA. ARPEPC agreed with his suggestion but advised him to submit your written suggestion to Director through head S&ESD. The committee advised him to continue Zn-biofortification, if wheat breeding program of PBGD intends to initiate breeding program on Zn-biofortification.

Dr. Syed Azam Shah, DCS

Dr. Syed Azam Shah, DCS has presented R&D project entitled "Integrated nutrient management of deciduous fruit orchards" which was discontinued on technical

grounds by committee in ARPEPM-2023. The committee asked Dr. Azam Shah about the reasons for continuing and presenting research project which was discontinued by the ARPEP committee last year (2023). Dr. Azam Shah alleged Head S&ESD for not intimating him about the minutes of ARPEPM-2023. Head S&ESD informed the house that minutes of ARPEPM-2023 were shared after its finalization with all scientists of S&SED division through email (cc to Director) on 02-11-2023 for information and compliance. When the committee argued that if you were not intimidated about discontinuation of your last year project then how you have mentioned just now in today's presentation at S. No. 12 that you have fulfilled the technical aspects regarding the last year comments, Dr. Azam Shah had no reply/response. The committee further told him that minutes of ARPEPM-2023 were circulated to all scientists and still exist on MIS.

During the technical discussion of above said project, the committee asked him whether peach plants being used in study were true-to-type or mutants. He admitted before the committee that the plants under study were mutants. The same fact he was intentionally hiding from the committee since last three years and insisted on not providing the desired information when the same was demanded from him through the Head S&ESD in writing. He confessed that Director through Head PBGD had collected the said information from Mr. Shahid Akbar Khalil, PS last year.

The Director was of the view that it was not possible to assess the partitioning /separate effect of mutants and nutrients applied to young peach plants. Dr. Azam Shah argued same like last year that since all mutants are budded on same root stock, therefore all mutants will behave similar to nutrients application. He claimed that he had discussed the matter with a Professor of Horticulture at University of Agriculture, Peshawar. The committee asked him to provide the same justification in writing duly supported with reference from the mentioned Professor. At the same time, Director offered him to come up with horticulturist from university or ARI, Tarnab to have further technical discussion on subject matter to resolve the issue. Dr. Azam Shah was further informed/reminded that according to your presentation, peach plants under your study were already at flowering and fruiting stage and technically could not be considered as young deciduous fruit (peach) orchards, so it is not of worth to continue the study. He had no technical justification for his project. He agreed to discontinue his study on integrated nutrient management of deciduous fruit orchards. He was further informed by the Director that similar project on plum had already been discontinued on same technical ground (plants being mutants) in 2021-22 ARP/IHR meetings. He was reminded the last year ARPEPC-2023 suggestions/recommendations that knowingly you have wasted the resources & time on technically unjustified project entitled "integrated nutrient management of deciduous fruit orchards" since its initiation especially 2021-22.

Dr. Azam Shah presented another project entitled "Development of high yielding rapeseed mutants adaptable to rain-fed areas in KP through nuclear interventions". The committee pointed out that this is ALP project and PI of this project is Hafiz Munir Ahmad, PS of PBGD but you have also claimed here the same project as PI. How there could be two PIs of the same project? Moreover, the study on drought tolerance

was planned to be conducted at BARS, Kohat according to the activities of said ALP project agreement/proposal but Dr. Azam Shah presented it to be conducted at NIFA because neutron probe is not allowed outside the institute. The committee told him that neutron probe can only measure available moisture in soil but have no relevancy with evaluation/screening of genotypes for drought/rainfed areas. The committee categorically told him that NIFA farm is not suitable location to conduct drought tolerance studies (as NIFA is not under drought prone range) particularly for brassica and chickpea as these crops have inbuilt drought tolerance. Similarly, the neutron probe data will not help in screening rapeseed mutants for drought.

Director advised Dr. Azam Shah to process local permission prior to be the part of funded/core project executed in another division (NIFA Annual Research Program Outlines for the Year 2022-23 at S. No. 03). Dr. Syed Jawad Shah, DCS raised query that in donor funded projects, if Co-PI is already included in a project, why a fresh approval is again needed as has been the case for project submitted by Mr. Hafiz Munir Ahmed, PS, PBGD to ALP by including Dr. Azam Shah as Co-PI? Director clarified that ARPEPC outlines of 2022-23 mentioned above approved earlier than project's formal approval and agreement. Director also showed to the entire committee with evidence that revised draft of the said project was submitted to ALP with ex-Director (Dr. Wisal Mohammad) scanned signature & stamp and sitting Director was by-passed due to unknown reasons. This was a gross misconduct, therefore ALP officials demanded signature & stamp of sitting Director. By this way, the sitting Director got information about the violation of Mr. Hafiz Munir, PS and Dr. Azam Shah, DCS by passing sitting Director and Head S&ESD. Director, NIFA further informed the committee and forum that he signed the revised project proposal and agreement in spite of gross misconduct of Mr. Hafiz Munir, PS and Dr. Azam Shah, DCS for the sake of NIFA and PAEC. Followings are committee precise suggestions:

1. Terminate R & D on "Integrated nutrient management of deciduous fruit orchards" as it had already been recommended by the concerned committee in 2023 because of solid technical reasons.
2. Drought tolerance experiment may be included in the ARPEP-2024 of Hafiz Munir Ahmad, PS under ALP project who shall seek formal approval afresh for conduction of said experiment if PI still needed the assistance of Dr. Azam Shah from S&ESD.
3. Committee desired to provide approved RD-1 form for the publication mentioned in the presentation.
4. Committee suggested him to submit a new core research project leading towards development of a marketable product (s) up to September 26, 2024 to Convener of ARPEPC through Head S&ESD. He submitted new project on September 25, 2024 accordingly.

His new submitted project was reviewed by the ARPEP committee in a meeting held on September 27, 2024. During the discussion, the committee suggested him to consider vegetables rather than wheat crop. The project may be executed in the field rather than in pots. Head S&ESD told him that this kind of R & D is already being

carried out in the division. Dr. Azam Shah responded that new project is different in a way that they are making compost, while he will simply take extract with water from onion peel and use it. Head S&ESD told him that compost tea is being brewed in simple water as solvent and in your case, onion peel extract can be used to brew the compost tea that will make it nutrients rich. The onion peel can be one of the materials for nutrient enrichment of compost tea rather than executing it as a full independent project. Head S&ESD had technical reservations on execution of this project, Dr. Syed Jawad Shah suggested to include comments of Head S&ESD in the ARPEP minutes document. As per suggestion of the committee members, the Head S&ESD technical comments/reservations are as follows on this new project:

- i. The availability of onion peels will be a limiting factor for successful execution of the project. Onion peels as such are not available as waste commodity.
- ii. Onion processing industry is not available in Peshawar that can serve to provide the material (onion peels) in bulk to develop a commercial fertilizer. Regular supply of onion peel wastes at the local level may also become a limiting factor towards the development of marketable product.
- iii. Onion peels do not contain major nutrients like nitrogen (according to his document) that is major source of nutrition for wheat production, K is already sufficient in soils and usually being not applied by farmers. Onion peels contain organic phosphorus that cannot be extracted directly with water. Therefore, developed product may not be of significance for crops.
- iv. The information given in background/justification shows that Onion Peels are rich in P, K and Ca but their quantifiable contents have not been provided, thereby making it difficult to evaluate practical application of the project.
- v. The idea of exploiting nutritional value (if rich) of onion peels may be integrated in already ongoing projects of division on nutrient enrichment of compost and compost tea instead of new core project on the same theme.
- vi. Statistics provided in background and justification, is about the total food waste but not about onion peels wastes which are only negligible portion of the total food waste.
- vii. Project activities are proposed to be started in November, 2024, it will not be feasible to collect large volume of onion peels, prepare tonic and analyse the tonic etc. It may not be possible to conduct the study timely with proposed objectives.
- viii. Under pot experiment it may not be possible to reach physiological maturity to get seeds for determining nutrients uptake.
- ix. The foliar spray as fertilizer may not be economical for major field crops like wheat which cover huge area for cultivation. Thus, it will require large quantity of foliar spray which is normally not possible because of many factors. PI seminar (as advised to Yasir Anwar, PS) is suggested before initiation of this project and expert evaluation e.g., NIAB/NIBGE/NIA soil scientists for better suggestions.
- x. The project shall be supported by references especially for such kind of product development at national and international level.

Mr. Yasir Anwar, PS

Mr. Yasir Anwar, PS presented his research plan for initiating a new project on mitigating the impact of greenhouse gases through irradiation. His project was thoroughly discussed and approved.

1. It was suggested to deliver a seminar on mitigation of greenhouse gases
2. It was also proposed to link the project activities to one of the major crops
3. He was suggested to include Dr. Amir Raza, PS as team member as he is also working on organic farming.

SOIL BIOLOGY & BIOCHEMISTRY GROUP**Dr. Amir Raza, PS**

Dr. Amir Raza, PS presented results from ongoing project on monitoring the long term impact of conversion to organic farming systems. Findings from the project were thorough discussed along with issues related to organic farming that were properly addressed by the concerned scientist. He was advised to include Mr. Yasir Anwar, PS in his project team.

Mr. Zahid Ali, PS

Mr. Zahid Ali, PS discussed results from studies on enrichment of agro-waste compost for nitrogen and phosphorous contents.

1. It was proposed to include additional nitrogen and phosphorous rich sources in the study.
2. Committee suggested to enhance reliability of results by conducting replicated analytical work.

Mr. Shahzada Asif Ali, SS

Mr. Shahzada Asif Ali, SS presented results from project on enrichment of compost tea for its nutritive value. It was proposed to improve volume and quality of work so that a marketable product can be developed

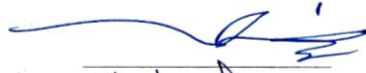
Dr. Haroon Shahzad, JS

Dr. Haroon Shahzad, JS discussed findings from studies related to development of effective microbial product. Committee took keen interest in results from the study and technical suggestions were made to enhance output from the project. Committee proposed to focus on product development for one of the major crops.

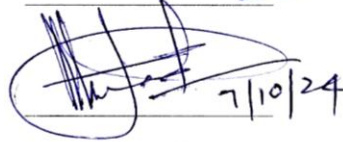
Dr. Roshan Zamir, Head PBGD concluded the session advised that all S&ESD scientists must publish their available data in reputed scientific journals (Each scientist shall have research paper as first author by next ARPEPM in 2025) and submit funded research projects.

ARPEPC Members Signatures

1. Dr. Muhammad Imtiaz, Head S&ESD



2. Dr. Syed Jawad Ahmad Shah, Head PPD




3. Dr. Maazullah Khan, Head FND



4. Dr. Roshan Zamir, Head PB&GD



5. Dr. Muhammad Amin, Manager ORIC/ Statistician



Dr. Gul Sanat Shah
Director NIFA