NIFA

Annual Research Programme 2022-23

Annual Research Programme 2022-23 Minutes
(NIF-X-RCD-06-026)

Annual Inhouse Review 2021-22 Minutes
(NIF-X-RCD-06-027)

Mid-Year Review 2021-22 Minutes
(NIF-X-RCD-06-027)

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Tarnab, Peshawar, Pakistan
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Pakistan Atomic Energy Commission
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C O N T E N T S

FOOD & NUTRITION DIVISION

Project #: 01

1. **Project Title:** Development of hybrid indirect type solar dryer for drying of fruits and vegetables
2. **Funding Source Type:** PAEC and ALP
3. **Principal Investigator:** Dr. Maazullah Khan, DCE
4. **Team Members (Scientists and staff):** Muhammad Zubair Shah, PE; Alamgeer Khan SS; Muhammad Asim Irshad, JS; Daulat Khan, PSA; Waseem Jan, Pr. Tech., Amjad Abbas; Muhammad Bilal.
5. **Overall Project Objectives:** To enable farmers/entrepreneurs reduce postharvest losses and increase their income through environment friendly renewable solar energy
6. **Specific Objective (If any):** Design and fabrication of a hybrid indirect type solar dryer for drying of fruits and vegetables
7. **Background and Justification:** Solar radiation is the primary source of energy for producing crops and their drying in the field. However, efficient and controlled utilization of this free of cost, safe and unlimited energy for drying of fruits and vegetables is still preliminary and needs to be developed. The proposed project is a continuation of the efforts to develop a solar dryer using modern but locally available gadgets for improved efficiency. Successful development and transfer of this dryer will enable the growers of KPK and rest of Pakistan to minimize postharvest losses and add value to their produce.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:** Nil
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **On-going/ awarded funded project (s) (PI/Co-PI):**

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Development of hybrid indirect type solar dryer for drying of fruits and vegetables (AE001)	PI: Dr. Maazullah Khan, DCE CO-PI: Mr. M. Zubair Shah, PE	ALP/Rs.3.21 M/ 2022-2025

   d. **Submitted funded project:** Nil
   e. **Published Research Paper:** Nil
   f. **Conducted Event (As PI/Co-PI):** Nil
   g. **Published Urdu/English articles in Zarat Nama/ Newspapers/Radio talks:** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    i. Preparation of detailed design of hybrid indirect solar dryer for drying 50 kg fresh fruits / vegetables
    ii. Preparation of detailed design for water heating and circulation system
    iii. Preparation of detail design of ventilation and control system for drying chamber
11. **Expected Output from the Next Year Planned Research Work:** Detailed design of hybrid indirect type solar dryer will be finalized with all auxiliary systems. Fabrication and installation of the proposed dryer will be carried out.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Persimmon fruit	300kg	30,000
2.	Repair of equipment if any		5,000
Grand Total			35,000

Requirements (2022-23)

S.#	Item	Quantity/#	Aprox. Expend. (Rs.M)
1.	Capital Cost		0.710
2.	Operating cost		0.945
		Grand Total	1.655

Project #: 02

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 and IAEA
3. **Principal Investigator:** Mr. Alamgeer Khan, SS
4. **Team member:** Mr. M. Zubiar Shah, PE, Dr. Maazullah Khan, DCE, Mr. M. Asim. Irshad, JS and Mr. Daulat Khan, PSA.
5. **Overall Project Objectives:** Adaptation of Low Energy Beams from Machine Sources for Food Irradiation.
6. **Specific Objective (If any):** Optimization of low energy X-rays irradiation process parameters for shelf life extension of Walnuts and Peas.
7. **Background and Justification:** Low Energy Electron Beam (LEEB) technology is now commercially available for aseptic packaging for polymer curing (polymers cross linking), printing ink curing, medical device sterilization, and aseptic food packaging. Presently, low energy e-beam units for spice treatment have been developed, tested, and are now commercially available. There is a growing pressure on the food industry to reduce their environmental impact namely, carbon footprint (CO2 release in the environment), reduced physical footprint (land usage), and reduced water usage, avoiding chemicals, and reducing energy demands. This has led to the beginning of a new approach of radiation processing of food and agricultural products using low energy beams.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. 1 kGy irradiation dose showed highest average ranking values of sensory evaluation for Gamma and X-rays of the Pine Nuts samples w.r.t. the control and other treatments during the six months storage period at ambient temperature.
      ii. No fungal counts were found for the irradiation doses of 1, 3, 5 and 7kGy respectively in treated Pine Nuts samples with both the irradiation technologies.
      iii. FTIR spectra of the Pine Nuts samples showed, that the functional groups were not significantly affected by the Co-60 gamma as well as low energy X-rays.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil

c. Ongoing funded Project (s) (PI/Co-PI):

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Adaptation of Low Energy Machine Generated Radiation Sources for Surface Decontamination and Disinfestation of Food in Pakistan (24289).	PI	IAEA/ 6.67 M, June, 2021 to June, 2026

d. Submitted funded project:

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates	Status
Promoting Food Irradiation by Low Energy Electron Beam Project Title (EB) and X-ray Technology to Enhance Food Safety, Security and Trade in Pakistan.	PI	IAEA/-/July, 2024 to June, 2027	Under review

e. Published Research Paper:

Khan, A., Shah, M. Z., Mehmood, Z., Irshad, M. A., Khan, M., & Ahmad, F. (2022). Effects of ionizing radiation sources and dose levels on quality characteristics of meal ready to eat (Minced cow meat). Pure and Applied Biology. Vol. 12, Issue 2, pp181-188. http://dx.doi.org/10.19045/bspab.2023.120019.

f. Events Organized (As PI/Co-PI):

Event title	PI or Co-PI
Awareness seminar on "Use of Electron Beam/X-rays Technology for Value Addition of Food Products and Gemstones" held at NIFA on July 05, 2022.	PI

9. Training attended:

Title	Period	Place
Officers Placement Course (OPC-I) (Virtual)	9-13 Aug 2021	NIFA, Peshawar

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023

i. Research will be carried out to improve the shelf life of dry fruits and vegetables.
ii. Irradiation of dry shelled Walnuts and fresh Peas samples with gamma and low energy X-rays.
iii. Comparison of physiochemical properties, microbiology and nutrient contents of the irradiated samples (control and among the treatments of both the irradiation technologies).
iv. Process parameters like radiation dose, dose rate and dose uniformity of irradiated samples will be evaluated.

11. Expected Output from the Next Year Planned Research Work:

i. Optimized irradiation doses for shelf life extension of shelled walnuts and peas.
ii. Optimized process parameters like radiation dose, dose rate and dose uniformity of irradiated samples for low energy x-rays.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expend. (Rs)
1.	As per approved project budget	-	As per approved project budget
		Grand Total	0.43 Million

Requirements (2022-23)

S.#	Item	Quantity/#	Expend. (Rs)
1.	As per approved project budget	-	As per approved project budget
		Grand Total	0.82 Million

Project #: 03

1. **Project Title:** Mitigation of post-harvest losses and value addition of fruits and vegetables
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Muhammad Asim Irshad (JS)
4. **Team Member (Scientist & Staff) :)**: Dr. Maazullah Khan, DCE; Dr. Zahid Mehmood, PS; Alamgeer Khan, SS; Daulat Khan, PSA
5. **Overall Project Objectives:** Development of Low Calorie Ready-to-Serve (RTS) Beverages
6. **Specific Objective (If any):** Low Calorie Ready-to-Serve beverage from pear, guava and Peaches
7. **Background and Justification (If new project):** Ready-to-serve (RTS) beverages made up of fruit pulp have greater amount of water that is useful for body balancing by preventing dehydration. Fruit drinks contain high percentage of sugar and provide a few vitamins and minerals. The consumption of fruit-based beverages in the form of fruit blends and smoothies is increasing due to public awareness on the presence of various functional ingredients beneficial to health. The limited intake of free sugars below 10% of total energy intake constitutes a healthy diet and further reduction to < 5% of total energy intake will result in additional health benefits
8. **Main findings of the Previous Year (2021-22) Work:**

a) Research findings:

i. On Spot Test was developed and optimized to determine foreign dye in red chili and turmeric powder
ii. Developed method performed better as compared to reported method
iii. Conc. Acid gave a better result as diluted acids won't perform reasonably
iv. Solvent should be added in optimized amount 1 g sample 5 ml solvent 2-5 ml Acids

b) Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c) Ongoing Awarded funded project (s) (PI/Co-PI): Nil

d) Submitted Funded Project (July 2021-22):

Project title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
"Innovating Radiation Processing of Food with Low Energy Beams from Machine Sources"	Co-PI	IAEA /Worth 30,000/- €	Rejected

e) Published Research Paper:

Khan, A., Shah, M. Z., Mehmood, Z., **Irshad, M. A**., Khan, M., & Ahmad, F. (2022). Effects of ionizing radiation sources and dose levels on quality characteristics of meal ready to eat (Minced cow meat). Pure and Applied Biology. Vol. 12, Issue 2, pp181-188. **http://dx.doi.org/10.19045/bspab.2023.120019**

f) Event Organized (As PI/Co-PI):

Sr. No.	Event title	PI or Co-PI
1.	Training on "Value Addition and Food Preservation" held at NIFA on 14th June, 2022.	Co-PI
2.	Awareness seminar on "Use of Electron Beam/X-rays Technology for Value Addition of Food Products and Gemstones" held at NIFA on July 05, 2022	Co-PI

9. Training attended:

Sr. No.	Title	Period	Place
1.	Two Days Training on "Calibration of Balances, Temperature Guages and Volumetric glassware"	16-17 May, 2022	NIFA, Peshawar
2.	3 Days Awareness Training Course for Lab based ISO/IEC 17025:2017Accreditation	25-27 January 2022	
3.	Post-graduate 36th training course on "The Use of Nuclear and other Techniques in Food & Agricultural Research"	04-15 October 2021	
4.	QMS Requirements and Implementation Based on ISO 9001:2015 standard by DQM	02-03 August 2021	
5.	QMS Auditor Certification Course Based on ISO 9001:2015 standard by DQM	04-06 August 2021	

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Development of low calorie RTS drink from Guava, Pear and Peaches
   I. Optimization of fruit conc.
      a. T_1: 25% fruit Concentration
      b. T_2: 30% fruit Concentration
      c. T_3: 35% fruit Concentration
      d. T_4: 40% fruit Concentration
   II. Replacement of synthetic sugar with natural sweetener
      a. T_4: 100% Sucrose
      b. T_5: 50% Sucrose 50% Stevia

c. T_6: 100% Stevia

ii. Physicochemical analysis and sensory evaluation of developed product will be performed

iii. Storage stability study of developed product will be performed

11. Expected Output from the Next Year Planned Research Work: Low-calorie RTS drink of Guava, Pear and Peaches

12. Expenditure and Requirements:

a) Expenditure (2021-22): Nil

b) Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Raw and packing materials		15,000
2.	Chemicals		15,000
3.	Raw Materials		5,000
4.	Miscellaneous		10,000
		Grand Total	50,000

Project #: 04

1. **Project Title:** Popularization, yield enhancement trial and cultivation optimization of edible mushroom as cottage industry
2. **Funding Source Type**: PAEC
3. **Principal Investigator:** Dr. Muhammad Ibrahim, PS
4. **Team members (Scientists & Staff):** Dr. Talat Mahmood, SS; Muhammad Nisar, ARO; Aurang Zeb Khan, PSA.
5. **Overall Project Objectives:** Popularization, yield enhancement and cultivation optimization of edible mushroom as cottage industry for poverty alleviation in the country.
6. **Specific Objectives**:
   i. Popularization of edible mushroom cultivation technology through farmers orientation to mushroom farming at NFA, through presentations/visits to local pharmaceutical industries for developing collaboration, and easy availability of NIFA mushroom spawn to farmers.
   ii. Comparative study of pearl oyster cultivation methodologies for yield enhancement.
   iii. Optimization of growing conditions of grey oyster for crop diversification.
7. **Background and Justification:** Edible mushroom cultivation is a very useful business as well as provide quality protein and popular medicine possessing therapeutic properties for human consumption. In less developed countries, mushroom cultivation as cottage industry can play important role in the economic uplifting of poor communities. In Pakistan, mushroom cultivation and production is quite low due to lack of awareness, motivation and training. Moreover, medicinal mushrooms are globally used for herbal medicine development and such mushroom (Ganoderma) could be used for development of possible indigenous medicinal products in Pakistan.
8. **Main findings from the Previous Year (2021-22) Research Work:**
   a. Research findings:
   i. Mushroom cultivation was popularized as cottage industry where farmers (26) orientation to mushroom farming was made through demonstration on available mushroom cultivation facilities at NIFA. These farmers from 8 districts (Peshawar, Nowshera, Charsadda, Mardan, Swabi, Buner, Swat and Bajaur) were provided with 103.5Kg of mushroom spawn and they have

developed 36 private mushroom farms which have contributed an increase of their income.

ii. NIFA Ganoderma as herbal medicinal mushroom was popularized among local Pharmaceutical industries, they showed interest and are planning to develop feasibility for possible product development on mutual consensus/agreement.

iii. Grey Oyster (*Pleurotus sajor caju*) is successfully cultivated in a preliminary trial at NIFA.

iv. Different composts (bagasse, wheat straw, paddy straw and saw dust) were tested for Ganoderma mushroom cultivation (fruit production) alone and in combination with each other (1:1 ratio), where wheat straw was found as best compost (mycelium run in 30 days, pinhead initiation in 34 days, fruit formation in 40 days and yielded 280g per bag) followed by wheat straw + saw-dust (34, 48, 53 days and yielded 210g per bag).

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: NIFA Ganoderma or Reishi (*Ganoderma lucidum*) was phytochemically analyzed and confirmed/quantified biologically active constituents i.e. Triterpenoids saponin, Polyphenols, Crude proteins, Minerals (Folic Acid, Ca, Mg, Cu, Fe, Zn, P) and Vitamins (A, D (287.61 IU/100g), C, B6, B2,) at PCSIR Laboratories complex, Lahore under collaboration with Pristine Pharmaceutical Pvt. Ltd. which has established sound foundation for future Ganoderma based product development and possible commercialization.

c. Ongoing/Awarded funded Project(s) (PI/Co-PI) (July 2021 to June 2022): Nil

d. Submitted funded project: (July 2021 to June 2022)

Project title	PI & Co-PI	Funding agency/total budget	Status
1. Popularization of mushrooms cultivation technology as cottage industry for poverty alleviation in the newly Merged Areas including Chitral of PK, Pakistan, NSLP-PSF, Islamabad. PROJECT NO. PSF/NSLP/KP-NIFA (935)	PI	NSLP-PSF/6.633 Million/	Rejected
2. Ganoderma medicinal mushroom products indigenization and commercialization through establishment of controlled environment facilities at NIFA, CRP-PSF, Islamabad. NIFA (PSF/CRP/TH/4/CFP/151)	PI	CRP-PSF/19.966 Million/	Rejected

e. Published Research Paper: Nil

Radio Talk: Delivered Radio Talk on “Mushroom Cultivation as cottage industry” On November 15, 2021 at Pakistan Broad Casting Radio Pakistan Peshawar.

f. Event organized (As PI/Co-PI): Nil

9. Training Attended:

Title	Period	Place
Three (3) Days Awareness Training Course Lab Based ISO/IEC 17025:2017 Accreditation for Jointly Organized by Food Safety Labs. NIAB Faisalabad (ISO/IEC 17025:2017 Certified NIAB) & Food Testing Lab, NIFA, Peshawar	25-27 January, 2022	NIFA, Peshawar

10. Summary of the Planned Research Work for the Year July, 2022 - June, 2023:

i. Popularization of edible mushroom cultivation technology through farmers on-farm orientation to mushroom farming at NIFA. New farmers will be introduced/practically demonstrated with compost preparation, compost pasteurization, compost inoculation and incubation and other relevant necessary environmental requirements and their maintenance for mushroom crop production. Edible mushroom will be popularized through presentation/visits to the local pharmaceutical/herbal industries for collaboration and development of possible indigenous Ganoderma products. Quality mushroom spawn will be developed at NIFA and will be made in time and easily available to farmers for popularization through establishment of private farms.

ii. Comparative study of pearl oyster cultivation methodologies for yield enhancement through cultivation in various dimensions of composts (16x22, 12x17, and 9x48 inches). The experiment will be cultivated under Completely Randomized Design (CRD).

iii. Grey oyster (new oyster strain) will be cultivated through optimization of growing conditions and substrate supplements for crop diversification.

11. Expected Output from the Next Year Planned Research Work: Edible mushroom cultivation technology will be popularized. Data on Improved cultivation methodologies will be obtained through R&D. Progress on cultivation optimization of grey oyster mushroom for crop diversification will be achieved through R&D data. Such popularization, yield enhancement through improved cultivation techniques, and grey oyster cultivation optimization for general cultivation will bring mushroom farming culture for nutritive food production and increase source of income of farmers through creating business and self-employment opportunities.

12. Expenditure and Requirements:

Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
01	Agar-Agar	01 Kg	22,000
02	Formalin	05 Liters	2000
03	Carbendazim	01 Kg	3000
04	Plastic bags (Autoclavable)	15 Kg	7500
05	Sorghum seed (4 bags)	200 Kg	32000
06	Lime 1 Bag	50 Kg	700
07	Wheat Bran 1 Bag	50Kg	2400
		Grand Total	69,600

Project #: 05

1. **Project Title:** Bio-pesticide (Botanicals) formulation and application for the management of yellow rust in wheat
2. **Funding Source Type:** PAEC
3. **Principal Investigator**: Dr. Muhammad Ibrahim, PS
4. **Team members (scientists & staff):** Dr. Talat Mahmood, SS; Muhammad Nisar Khan, ARO; Aurang Zeb Khan, PSA
5. **Overall Project Objectives:** Field testing of bio pesticidal activity of plant extracts (botanicals) against yellow rust in wheat, and its formulation for future possible commercialization as product(s).
6. **Specific Objectives:** Plant extracts/botanicals with bio-pesticidal activity will be tested/identified for its efficacy against yellow rust in wheat. Biopesticide/plant extract will be emulsified and formulated for product development for possible commercialization as low cost biopesticide both farmer and environment friendly.
7. **Background and Justification:** Biopesticides are naturally occurring, biological compounds used for managing various agricultural pests (pathogens and pests) without damaging environment. In contrary, chemical pesticides used for crop protection, pose long-term threats/risks to living beings and ecosystem due to their harmful side effects because of their nondegradable effects.
8. **Main findings from the Previous Year (2021-22) Research Work:**
   a. Research findings:
   i. Botanicals extracts (*Melia azedarach*, *Azadirachta indica* and *Withaina coagulans*) showed urediospores germination inhibition properties in laboratory conditions thus showed its potential as antifungal agent.
   ii. Highest % field efficacy (95.2%) was exhibited by emulsified forms of both *Azadirachta indica* @ 50g/L and *Melia azedarach* @ 50g/L followed by (90.5%) emulsified form of Oil @ 5ml/2Ltrs of water.
   iii. Detergent and Sodium Carbonate was used as emulsifying agent for emulsification of Botanicals extracts (*Melia azedarach*, *Azadirachta indica* and *Withaina coagulans*) and Mineral Oil & Neem oil, respectively (Emulsification quality will be tried for improvement in the next season).
   b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil
   c. Ongoing funded Project (s) (PI/Co-PI): Nil
   d. Awarded/submitted funded project: Nil
   e. Published Research Paper: Nil
   f. Event Organized (As PI/Co-PI): Nil
9. **Training Attended:**

Title	Period	Place
Three (3) Days Awareness Training Course Lab Based ISO/IEC 17025:2017 Accreditation for Jointly Organized by Food Safety Labs. NIAB Faisalabad (ISO/IEC 17025:2017 Certified NIAB) & Food Testing Lab, NIFA, Peshawar	25-27 January, 2022	NIFA, Peshawar

10. **Summary of the Planned Research Work for the Year July, 2022 - June, 2023:**

    Botanicals extracts (*Melia azedarach*, *Azadirachta indica* and *Withaina coagulans*), Neem Oil and Mineral Oil will be tried for its improved emulsification and then will be applied for the management of yellow rust in wheat field at NIFA.

11. **Expected Output from the Next Year Planned Research Work:**

    Botanicals extracts (*Melia azedarach*, *Azadirachta indica* and *Withaina coagulans*) will be tried for improved emulsification, then it will be tested for its enhanced efficacy for the management of yellow rust in wheat field.

12. **Expenditure and Requirements:**

    Expenditure (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Leaves of Bakain, Neem, Paneer doda, Neem Oil	1 Kg each	4000
2	Arabic gum	1/2kg	1000
3	Synthetic fungicide (Tilt)	250ml	1000
		Grand Total	6000

Project #: 06

1. **Project Title:** Development & production of probiotic foods by using bio-preservation techniques.
2. **Funding Source Type:** PAEC and SPD
3. **Principal Investigator:** Dr. Talat Mahmood, SS
4. **Team member (scientists & staff):** Dr. Muhammad Ibrahim, PS; Masood Khattak, Supervisor
5. **Overall Project Objectives:** To develop indigenous bio-preserved probiotic foods by using bio protective cultures and their peptides at lab scale
6. **Specific Objective (If any):**
   i. Isolation and identification of lactic acid bacteria and their screening bacteriocin production
   ii. Purification of bacteriocin through organic solvent and salts of ammonium and sodium
7. **Background and Justification:** Commercial preservation of food commodities started in 19th century mostly by chemical preservation. Main purpose was to extend shelf life of food products especially during the Second World War when there was severe shortage of food in the war fields. However, in classical approaches of preservation, food is mostly preserved by expensive thermal processing or hazardous chemical preservation. As an alternated, bio-preserved probiotic foods not only improve shelf life of the food but also enhance its nutritional value. In Pakistan various R&D organizations and universities have been working on the bio-preservation and probiotic food development but locally made bio-preserved food rarely available. At NIFA, Food and Environment Safety group started work on this aspect under the umbrella of ALP project in 2018. Initially R&D work was started on bio-preservation and scope was extended to probiotic food development.

8. Main findings of the Previous Year (2021-22) Work: (Brief findings)

a. Research findings:

i **Characterization of bacteriocin as bio preservatives**

a. Tricine sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) was carried out for the quantification of molecular weight. It was observed that bacteriocin had a single band of molecular weight of about 8.5 KDa indicating that bacteriocin identified came in the class-II Non-lanthionine

b. SDS-PAGE of S-layer cell wall protein analysis was also carried out. All strains have seven prominent bands along with some minor bands. The molecular weights of these prominent bands were 27, 34, 37, 40, 45, and 60 kDa.

ii **Characterization of probiotic cultures for safety parameters**

Hemolysis analytical profile of selected strains was determined by growing fresh bacterial culture on blood agar supplemented with 5 % sterilized sheep blood. No hemolysis for all strains indicating that these strains were safe to be used without any harmful effect on the body.

iii **Application of bacteriocin as a bio preservative in different food products**

Lactic cheese was developed by using three strains Developed cheese was assessed for different quality characteristics and cheese developed with NIFA-1 was selected as best suited strain.

iv **Quality evaluation of Honey for establishment honey testing facilities at NIFA.**

Five different brands of honey were selected from local market and assessed for different quality tests. In total eight tests were standards and are now available for customer.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department:

The accreditation of ISO-17025:2017 for four microbiological tests is in process. Pre-assessment has been completed and all other requirement has now been completed.

c. Ongoing funded Project (s) (PI/Co-PI): Nil

d. Approved funded project:

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Development & production of probiotic foods by using bio-preservation techniques	Dr. Talat Mahmood	SPD / 10 Million / July 22 to June, 2025**.**

e. Published Research Paper: Nil

f. Conducted Event (As PI/Co-PI):

Event title	PI or Co-PI
Awareness training Course for lab-based ISO/IEC 17025:2017 accreditation	PI

9. Training attended:

Event	Period	Place
Raman and Fourier Transform Infrared Spectroscopy PINSTECH	04-04-22	05-04-22

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. **Screening of lactic acid bacterial cultures for bio-preservative production**

50 *dahi* and pickle samples will be collected from different region of KP. The isolates will be screened for antibacterial activities and desired able isolates will be selected for further studies

ii. **Identification of lactic acid bacteria through microbiological and molecular techniques**

Selected strains will be identified through classical microbiological techniques, API 50 CHL system and PCR based sequences

iii. **Exploration of yeast probiotic strains isolated from indigenous fermented foods**

Yeast will be isolated from fermented food and screened for antibacterial activities and probiotic characteristics

11. Expected Output from the Next Year planned Research Work:

i. Production of bacteriocin as bio-preservative and application in various foods like in fruits and vegetable, poultry and meets

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Consumable		50,000/-
2.	Others		10,000/-
Grand Total			60,000/-

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1.	Consumables store		50,000/-
2.	Analysis samples from other institute	10 samples	30,000/-
		Grand Total	80,000/-

Project #: 07

1. **Project Title**: Quality and Safety Assessment of Drinking Water in Local Vicinity Peshawar
2. **Funding type**: PAEC
3. Principle investigator: Muhammad Nisar, ARO
4. **Team members:** Dr. Muhammad Ibrahim PS; Dr. Talat Mehmood SS; Arshad Ali PSA; Aurang Zeb Khan PSA.
5. **Overall project objectives**: To estimate the quality and safety of drinking water in local vicinity of Peshawar.
6. **Specific objective (if any):**
   i. Qualitative and quantities assessment of heavy metals in drinking water
   ii. Microbial contamination in drinking water
7. **Background and justification (if any):** Water is an essential substance to support life and the ecosystem. Water is a universal solvent, therefore, dissolve or suspend several lives essential and non-essential materials and may serve as a

medium for the survival of numerous microorganisms. The contaminants such as microorganisms in the water are considered key factors and associated with various types of diseases occurred in dependent living organisms. Deep groundwater is considered a common and safe source of drinking water. A number of studies have reported groundwater contamination with chemicals, calcium sodium potassium magnesium etc and heavy metals as well as infectious microbial agents. Studies on physiochemical contamination of drinking water had attracted global attention because of improper public health impacts. Quality of drinking water is a significant characteristic associated with waterborne diseases.

8. **Main finding of the previous year (2021-22) Work**:
   a. **Research findings:** N/A
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing funded Project (s) (PI/Co-PI):** Nil
   d. **Submitted funded project:** Nil
   e. **Published Research Paper:** Nil
   f. **Conducted Event (As PI/Co-PI):** Nil
9. **Training attended** Nil
10. **Summary of planned research work for the year 2022 - 2023**
    i. Collection of samples: Sample will be collected from the 20 different locations of Peshawar city. With collaboration of public health department Sample will be brought in the lab for further chemical and microbial analysis
    ii. Heavy and light metals estimation: Sample will be prepared as per the method given in American Public Health Association (APHA) 23rd Ed. 2017 and will be analyzed for Na, K, mg and Ca estimation
    iii. Microbial analysis: For the estimation of safety parameters samples will be analyzed for microbial contamination.
11. **Expected Output from the Next Year Planned Research Work:**
    i. Strengthening of Food Testing Lab for assessment of Na, K, Mg and Ca
    ii. Provision of analytical facilities for public and private organization
12. **Expenditure and Requirements:** Expenditure (2022~2023)

S. No	Item	Quantity/#	Expenditure. (Rs)
1	Consumable		200,000/-
2	Others		80000/-
3	DPL		300,000/-
		Grand Total	580000/

Project #: 08

1. **Project Title:** Development of an indigenous technology for the quantitative determination of Vitamin-A in oils/ fats
2. **Funding Source Type:** PAEC and Nutrition International (NI)
3. **Principal Investigator:** Dr. Zahid Mehmood, PS
4. **Team member (Scientists & Staff):** Ali Raza, SS; Tauqeer Ahmed, JS; M. Zubair Shah, PE; Asif Murad, PE**;** Shamshad Ali, PSA; Umme Kalsoom, SA-I; Haider Ali, Mali-I
5. **Overall Project Objectives:** To develop and optimize an indigenous digital Vitamin-A Meter for the quantitative determination of Vitamin-A in oils/ fats.

6. **Specific Objective (If any):**
   i. To develop an indigenous digital Vitamin-A Meter (VITA-Meter) for the quantitative determination of Vitamin-A in oils/ fats.
   ii. To optimize and validate the VITA-Meter for different fat and oils.
   iii. To improve RTK qualitative detection of vitamin A in soya bean oil
7. **Background and Justification:** Micronutrient deficiency in the Pakistani population is at alarming level. Keeping this situation in view, government has made fortification of oil and ghee with Vitamin A and D mandatory for oil/ghee mills. NIFA has developed spot test kits for qualitative testing of Vitamin-A in oil and ghee samples. In this backdrop, a digital Vitamin-A Meter (VITA-Meter) will be developed indigenously as a joint venture between NIFA, Peshawar, and ICCC. VITA-Meter will assist regulatory bodies to monitor and quantitatively check the level of vitamin-A in dietary oils
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:** New project
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):**

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
1. Strengthening National Capabilities to Mitigate Vitamin A Deficiency in the Pakistani Vulnerable Population Using Stable Isotope Techniques	PI	IAEA TC /Rs. 92 Million/01-01-2020 to 31-12-2022
2. Development of Rapid Test Kit (RTK) for Qualitative Determination of Peroxide Value (POV) to Check Rancidity in Fat/Oils and its Dissemination to End-Users	Co-PI	PAEC R&D Fund for Member Science Setup/ 1.0 million PKR/ July 2021 - June 2022

   d. **Submitted funded project:**

Project title	PI & Co-PI	Funding agency / total budget / starting & completion dates	Status
1. Digitizing Pakistan's Vitamin-A Oil Fortification Program to Drive Sustainability	PI	Nutrition International/ 2.6 Million/ 1.5 years	In-process
2. Randomized Controlled Trial on the Efficacy of Zinc-Fortified Wheat	PI	International Food Policy/91 Million/ 1.5 years	Rejected
3. Development and dissemination of low-cost zero-energy cooling chambers for storage of	PI	Research Institute (IFPRI) / 91 Million/ 1.5 years	Rejected

fruits and vegetables in KP		KP Govt./ 10 Million/ 2 years	
4. Development of modified atmospheric packaging (MAP) for post-harvest management of high value fruits and vegetables	PI	SPD / PAEC / 12.5 Million/3 years	Rejected
5. Assessment of Vitamin-A Profile among Pakistani Population using Nuclear Retinol Isotope Dilution (RID) Technique	Co-PI	IAEA/30,000 Euros/5 years	Rejected

e. Published Research Paper:

Khan, A., Shah, M. Z., **Mehmood, Z**., Irshad, M. A., Khan, M., & Ahmad, F. (2022). Effects of ionizing radiation sources and dose levels on quality characteristics of meal ready to eat (Minced cow meat). Pure and Applied Biology. Vol. 12, Issue 2, pp181-188. http://dx.doi.org/10.19045/bspab.2023.120019

f. Events Organized (As PI/Co-PI):

Event title	PI or Co-PI
1. Training course for PAF officers: Organized one-week training for PAF Officers from Jan 03-07, 2022	PI
2. Training on Development of low cost zero-energy cooling chambers (ZECC) for field heat removal and storage of fruits and vegetables on Jan 25, 2022 at Haripur	PI
3. Training on Development of low cost zero-energy cooling chambers (ZECC) for field heat removal and storage of fruits and vegetables on June 28, 2021 at Swat	PI
4. Development of Rapid Test Kit (RTK) for qualitative determination of POV in oils & fats and its dissemination to end users on May 24, 2022	Co-PI

9. Trainings Attended:

Title	Period	Place
E-Learning Course on the Electron Beam Accelerator and its Applications under the RCA/UNOSSC Project on Electron Beam Application (Virtual)	30 Aug –10 Sept, 2022	PAEC, HQs, Islamabad

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Research work will be carried out to improve RTKs efficacy for edible oils with special reference to soybean oil (NIFA)
ii. Design and manufacturing VITA-Meter, PCB and Mechanical enclosure will be carried out at ICCC, Islamabad.
iii. R&D on the optimization of reagents for VITA-Meter for Vitamin-A quantification will be performed at NIFA, Peshawar
iv. Validation of the VITA-Meter with the reference methods on different fat and oils will also be carried out at NIFA, Peshawar.

11. Expected Output from the Next Year Planned Research Work:

i. A digital VITA-Meter will be developed indigenously for the quantification of Vitamin-A
ii. Detection of Added vitamin A in soybean oil

12. Expenditure and Requirements:

Expenditure (2021-22):

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Trainings and transportation	02	80,000
2	Supplies & Lab Analysis etc		100,000
3	ZECC	02	204,000
4	DPL	01	150,000
5	Misc		150,000
		Grand Total	0.684 Million

Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Million Rs)
1	Design and development of VITA Meter (LED, Light Detector, Controller, Display)	01	1,600,000
2	Supplies & Lab Analysis etc		200,000
3	DPL	01	100,000
4	Misc		100,000
		Grand Total	2.0 Million

Project #: 09

1. **Project Title:** Development of Nutritional Food Supplement (NFS) for Children
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Ali Raza, SS
4. **Team Member (Scientist & Staff):** Dr. Zahid Mehmood, PS; Mr. Tauqeer Ahmad, JS; Shamshad Ali, PSA and Ms. Umme Kulsoom/ SA-I
5. **Overall Project Objectives:** To overcome the prevalence of malnutrition in school going children in Pakistan.
6. **Specific Objective (If any):**
   i. To develop a nutritional food supplement (NFS) from locally available food ingredients.
   ii. To evaluate the shelf life and acceptability of NFS
7. **Background and Justification (If new project):** Inadequate energy and micronutrient intake during childhood is a major public health problem in developing countries. In Pakistan, four out of ten children under five years of age are stunted while 17.7% suffer from wasting. The double burden of malnutrition is becoming increasingly apparent, with almost one in three children underweight (28.9%) alongside a high prevalence of overweight (9.5%) in the same age group. Malnutrition is nearly always accompanied by deficiencies of essential micronutrients such as more than half (53.7%) of Pakistani children are anaemic and 51.5% of children suffer from vitamin A deficiency. Supplementation with nutritious food is imperative for children to reduce these malnutritional problems, especially those who cannot afford an adequately diverse diet. To reduce the burden of malnutrition among young children; a new supplementary food made from low-cost locally available food ingredients needs to be developed in Pakistan.

8. Main findings of the Previous Year (2021-22) Work:

a. Research findings: New Project

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing/Awarded funded project (s) (PI/Co-PI): Nil

d. Submitted Funded Project (July 2021-22): Nil

Sr. No	Project title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
i.	Assessment of Vitamin-A Profile among Pakistani Population using Nuclear Retinol Isotope Dilution (RID) Technique	PI	IAEA, worth 30,000 Euros	Regretted
ii.	Randomized Controlled Trial on the Efficacy of Zinc-Fortified Wheat	Co-PI	International Food Policy Research Institute (IFPRI) worth 91 Million PKR	Regretted
iii.	Digitizing Pakistan's Vitamin-A Oil Fortification Program to Drive Sustainability	Co-PI	Nutrition International (NI) worth 2.6 Million PKR	In-Process

e. Published Research Paper:

Published a brochure on the "Importance and Usage of NIFA Peroxide Value (POV) Spot Test Kit".

f. Event Organized (As P-organizer/Co-organizer):

Sr. No	Event title	P-organizer /Co-organizer
i.	Training workshop on "Development of Rapid Test Kit (RTK) for qualitative determination of Peroxide Value (POV) in oils & fats and its dissemination to end users" at NIFA, Peshawar on 24 May 2022.	P-organizer
ii.	Training on Development of low cost zero-energy cooling chambers (ZECC) for field heat removal and storage of fruits and vegetables on Jan 25, 2022 at Haripur	Co-organizer
iii.	9th Training Course for PAF Officials on "Modern Food Handling Techniques"	Co-organizer
iv.	One-day Training on the "Determination of anti-nutrient i.e. Phytic Acid in wheat flour" and "Importance and usage of NIFA Spot Test Kits"	Co-organizer

9. Training attended:

Sr. No.	Title	Period	Place
i.	Lab based ISO/IEC 17025:2017 Accreditation	25-27 January 2022	NIFA, Peshawar
ii.	QMS Requirements and Implementation Based on ISO 9001:2015 standard by DQM	02-03 August 2021	
iii.	QMS Auditor Certification Course Based on ISO 9001:2015 standard by DQM	04-06 August, 2021	

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Formulation of the NFS will be as follows:

Sr. No.	**Ingredients**	**Quantity (g/100g)**
i.	Rice Powder	40
ii.	Lentil Powder	20
iii.	Skimmed Milk Powder	10
iv.	Peas Concentrate	5
v.	Brown Sugar	5
vi.	Fruit Concentrate	5
vii.	Vegetable Concentrate	5
viii.	Groundnuts powder	7
ix.	Vegetable Oil	3
x.	Vanilla Flavor	1-2 ml

ii. NFS will be packed in polyethylene bags and stored in refrigerator (2-8 ±2℃) and inside lab at room temperature (25±5℃) to determine its shelf-life and analyzed for different quality control parameters to determine its shelf life as follows:
   a. Estimation of nutritional composition (protein, fat, dietary fiber, total phenolic content)
   b. Estimation of chemical properties (pH/acidity, moisture contents, peroxide value, free fatty acids, ash)
   c. Estimation of micronutrient composition (vitamin-A, Vitamin-C, iron)
   d. Sensory evaluation of NFS.

iii. NFS will be fed to children of NIFA employees to determine its acceptability.

11. Expected Output from the Next Year Planned Research Work:

Development of a low-cost nutritionally rich food supplement to overcome malnutrition in Pakistani children.

12. Expenditure and Requirements:

Expenditure (2021-22):

S.#	Item	Quantity/#	Expenditure. (Million PKRs)
1.	Equipment		0.35
2.	Research Materials		0.40
3.	Communication/Utilities		0.25
		Grand Total	1.0

Requirements (2022-232)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Raw and packing materials		20,000

2.	Chemicals		20,000
3.	Miscellaneous		5000
		Grand Total	45,000

Project #: 10

1. **Project Title:** Development of Rapid Test Kit (RTK) for on-spot Detection of fortified Zinc (Zn) in Fortified Wheat Flour
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Mr. Tauqeer Ahmad, JS
4. **Team members (Scientists & Staff):** Dr. Zahid Mehmood, PS, Mr. Ali Raza, SS, Mr. Shamshad Ali/ PSA, Ms. Umme Kulsoom/SA-I, Mr. Haider Ali/ Mali-I
5. **Overall Project Objectives:** To develop a rapid test kit for on-spot detection of added Zinc (Zn) in fortified wheat flour
6. **Specific Objective (If any):** To optimize & develop a qualitative analytical method/tool for detection of added Zn in fortified wheat flour
7. **Background and Justification:** Zinc is one of the most important trace elements in the organism, with three major biological roles, as catalyst, structural, and regulatory ion. Effects of its deficiency include oxidative damage, alterations in the immune system, neuropsychological impairment and dermatitis. The Recommended Dietary Allowance (RDA) for adults is 11 mg a day for men and 8 mg for women. According to National Nutrition Survey (NNS) 2018, the prevalence of Zn deficiency is 18.6 % among Pakistani population. Fortification of Zinc in wheat flour (a staple diet of Pakistani population) can be an effective tool to minimize Zn deficiency among vulnerable population groups of Pakistan. The current study is aimed to develop a rapid test kit to detect added Zn in wheat flour.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:** New Project
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):** Nil
   d. **Submitted funded project:**

Sr. #	Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates	Status
a)	Assessment of Vitamin-A Profile among Pakistani Population using Nuclear Retinol Isotope Dilution (RID) Technique	Co-PI	IAEA, worth 30,000 Euros	Regretted
b)	Randomized Controlled Trial on the Efficacy of Zinc-Fortified Wheat	Co-PI	International Food Policy Research Institute (IFPRI) worth 91 Million PKR	Regretted
	Digitizing Pakistan's Vitamin-A Oil	Co-PI	Nutrition International (NI)	In-Process

	Fortification Program to Drive Sustainability		worth 2.6 Million PKR	

e. **Published Research Paper:** Published a Brochure with title “NIFA Iron Spot Test Kit”

f. **Events organized (As P-organizer/Co-organizer):**

Event title	P-organizer/ Co-organizer
i. 9th Training Course for PAF Officials on “Modern Food Handling Techniques” at NIFA, Peshawar from 3-7 January 2022 ii. 01-day Training workshop on “Development of Rapid Test Kit (RTK) for qualitative determination of Peroxide Value (POV) in oils & fats and its dissemination to end users” at NIFA, Peshawar on May 24,2022 iii. One day Hands-on Training on “Determination of anti-nutrient i.e. Phytic Acid in wheat flour” and “Role of NIFA Spot Test Kits in Qualitative Analysis of different Food Items” to the students of Department of Human Nutrition, University of Agriculture, Peshawar on 7th June 2022	Co-organizer

9. Trainings attended:

Title	Period	Place
1. 3 days Awareness Training Course for “Lab based ISO/IEC 17025:2017 Accreditation”	25-27 January 2022	NIFA, Peshawar
2. Training on “Value Addition and Food Preservation	16 June 2022	
3. One-day awareness seminar on “The Use of Electron Beam/X-Ray Technology for Value Addition of Food Products and Gemstones”	05 July 2022	
4. 2 days Training Course on “QMS Requirements and Implementation Based on ISO 9001:2015 standard by DQM” (Successfully completed)	02-03 August 2021	
5. 3 days Training on Course Assessment and Examination for “QMS Auditor Certification Course Based on ISO 9001:2015 standard by DQM” (Successfully completed)	04-06 August 2021	
6. 36th Postgraduate Training Course on “The Use of Nuclear and other Techniques in Food & Agricultural Research” (Successfully completed)	04-15 October 2021	

10. Summary of the Planned Research Work for the Year July, 2022 - June, 2023:

i. Procurement of raw material e.g. wheat flour fortified with fortificant premix containing Zn along with other micronutrients

ii. R&D on method standardization (Atomic Absorption Spectroscopy) for quantification of Zn in fortified wheat flour samples
iii. R&D on the development of on-spot testing method/tool for detection of added Zn in fortified wheat flour.

11. Expected Output from the Next Year Planned Research Work:

Method standardization to develop a qualitative analytical method/tool for detection of added Zn in fortified wheat flour

12. Expenditure and Requirements:

Expenditure (2021-22):

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Chemicals		15,000
2	Glassware		5,000
3	Research materials		5,000
		Grand Total	25,000

Requirements (2022-23):

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Procurement of Raw Material (wheat flour, fortificant premix etc.)		25,000
2	Sample Analysis		20,000
3	Miscellaneous		5,000
		Grand Total	50,000

PLANT BREEDING & GENETICS DIVISION

Project #: 01

1. **Project Title:** Evaluation of plum germplasm/mutants for yield/fruit quality and other parameters.
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. Muhammad Tariq, PSA
   - Mr. Mustaqeem Shah, G. Attdt.
5. **Overall Project Objectives:** To evaluate plum germplasm/mutants for development of high yielding, early bearing and better fruit quality plum genotypes through induced mutations and introduction.
6. **Specific Objective (If any):** Nil
7. **Background and Justification**: Plum is an important fruit crop of Khyber Pakhtunkhwa province of Pakistan due to the prevailing conducive agro climatic conditions. But the fruit production of plum is low in Pakistan due to numerous reasons, including non-availability of improved varieties and certified fruit nurseries for the commercial orchard growers. Therefore, improvement of plum for high yield, and better fruit quality through different approaches is essential. Initially the local selections and mutants of plum are under evaluation for fruit maturity, dwarfism and fruit quality.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. Research findings:
      i. The effect of gamma rays (20 and 30 Gy) on 09 mutant plants of plum was carried out and out of 09 plants the earliest sprouting was recorded in one mutant plant which also has the lowest plant height of 140.5 cm.
      ii. Similarly in 20 Gy treatment all mutants start sprouting in 2nd week of February with the lowest plant height of 150 cm
      iii. 04 Local germplasm of plum were also evaluated for adaptability in orchard. In all local germplasm vigorous growth with highest plant height was recorded in Santa Rosa.
      iv. Experiment on budding of 03 varieties (Beauty, F Manani and Santarosa) using different PGRs (IAA, IBA and GA_3) was carried out. Significantly ($p \leq 0.05$) highest sprouting of 66.4 % was recorded in IAA treated Santa Rosa plum.
      v. The mariana plum rootstocks were raised in the nursery and budded with Black plum variety treated with 20 and 30 Gy doses. No sprouting was observed in any dose.
   b. Crop/Variety/Patent/Lab. accreditation/Product certification: Nil
   c. Ongoing/awarded funded Project (s) (PI/Co-PI): Nil
   d. Awarded funded project: Nil
   e. Published Research Paper: Nil
   f. Event organized (As PI/Co-PI): NIFA Farmers/Seed Day 2022, Seed companies meeting
9. **Training attended:** Nil

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Evaluation of Mutant plants of Plum (20-30 Gy) for desirable characters in the orchard for sprouting, height and early blooming.
ii. Genetic variability will be created in bud wood through induced mutations by subjecting plum variety Santa Rosa bud wood at (20 and 30 Gys) gamma rays.
iii. Recording of morphological data of individual local selection in the orchard for growth, branches and fruiting.
iv. Parameters for ideal, compact growth and braches will be carried out from budded plants. Caring and removing of plastic from budded plants will also be carried out at proper stage.
v. Budded plum materials subjected to gamma rays will be shifted to the orchard for evaluation. The initial data will be collected on the morphological characteristics like number of nodes per buddling, number of leaves per buddling, number of branches per buddling, number of shoots per buddling, plant height (cm) and buddling diameter (cm) of individual mutant plants.
vi. Visits will be conducted to various farmer's plum orchards and Research centers during fruiting/blooming stage and selections of desired plum plants (land races) will be carried out.
vii. Cuttings of Mariana plum rootstocks will be made and planted in raised beds for raising the nursery for budding of selected scion wood.
viii. Cultural practices like pruning, weeding, spraying in the irradiated and selected material in orchard as well as in the nursery will be carried out.
ix. Bud wood of Black Plum Cv. "Black Amber" will be irradiated and budded on rootstock for evaluation and possibility of cultivation in plan areas of KP.

11. Expected Output from the Next Year Planned Research Work: Material generation for development of variety.

12. Expenditures and Requirements:

Expenditure (2021-22) (whole Group):

S.#	Item	Quantity/#	Expenditure. (Rs)
01	DPLs	263	131,500/-
02	POL charges		87750/-
		Grand Total	219250/-

Requirements (2022-23):

S.#	Item	Quantity/#	Apro. Expend. (Rs)
01	DPLs	263	131,500/-
02	Farm maintenance share of DPL	48	24000/-
03	POL		87750/-
04	DAP (bag)	01	12000/-
05	Urea (bag)	01	3000/-
06	Insecticides/weedicides	04 bottles	8000/-
		Grand Total	290250/-

Project #: 02

1. **Project Title:** Improvement of peaches for yield and quality
2. **Funding Source:** PAEC
3. **Principal Investigator:** Mr. Shahid Akbar Khalil, PS
4. **Team member (Scientists & Staff):**
   - Dr. Roshan Zamir, DCS,
   - Mr. Muhammad Tariq, PSA

- Mr. Mustaqeem Shah, G. Attendant.

5. **Overall Project Objective (s):** Development of short stature, high yielding and quality peach genotypes through induced mutations/introduction/selection
6. **Specific Objective (If any):** Study of exotic/local/mutants for further evaluation.
7. **Background and Justification:** Peach trees are propagated on standard (seedling) rootstock that covers about 7.50 x 7.50 m plant to plant distance with a 6.5 m height. This setup not only makes the orchard operations difficult but quality and quantity of the fruit is also affected. 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.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. The harvesting date of plawhite-5 is 16 days earlier than the harvest date of early grand.
      ii. Plawhite-5 has attractive fruit colour with medium size and desirable TSS value.
      iii. Zincle-4 is a very good looking and early maturing (harvest in last week of April)
      iv. Average fruit weight 81.99 g, fruit shape is round, fruit size 51.60/55.40 mm, fruit colour red and TSS 9.50 ° brix.
      v. Selection from local peach orchard has maximum fruit weight with high TSS ^{0}brix as compared to early grand.
      vi. Two selection were collected in farmer's orchard and budded on peach rootstock at NIFA.
      vii. Flowering, full bloom & number of fruits were noted in 05 mutant plants of early grand & 07 mutant plants of florida king.
      viii. The biochar experiment were conducted in peach nursery using different doses of biochar. Maximum germination (32.34 %) were recorded in soil treated with 25 kg biochar as compared to control (28.03 %).
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):** (July 2021-June 2022)

Project title	PI & Co-PI	Funding agency/total budget/starting & completion dates
Sustainable Approach for Effective Control of Peach Stone Replant Disorders	Mr. Shahid Akbar Khalil, PS/PI Dr. Roshan Zamir, DCS/Co-PI	PSF/Rs. 2.8 millions/ 01.09.2022 – 31. 08.2025

   d. **Submitted funded project:** Nil
   e. **Published Research Paper:** Nil
   f. **Event organized (As PI/Co-PI:** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023**
    i. Two exotic germplasm (Plawhite-5 & Zincle-4) will be evaluated for early maturity, dwarfism and fruit characters in orchard.

ii. Local germplasm selected from farmer field at Charsadda will be studied for desirable characters and evaluation.
iii. Mutant plants of early grand & florida king will be further studied for evaluation. The parameters will be studied i.e., flower initiation, days to full bloom, fruit setting, days to fruit setting, number of fruits per mutant plants, fruit weight, fruit size, fruit colour, fruit shape, vitamin c content, acidity & TSS etc.
iv. Two new selections were budded on peach rootstock at NIFA and will be transferred to peach orchard on January, 2023.
v. Visits will also be conducted to farmers' field for local land races selection of desirable peach plant.

11. **Expected Output from the Next Year Planned Research Work:** Material generate for development of peach varieties
12. **Expenditure and Requirements:** Provided in the 1st project

Project #: 03

1. **Project Title:** Sustainable approaches for effective control of peach stone replant disorders
2. **Funding Source:** PSF
3. **Principal Investigator:** Mr. Shahid Akbar Khalil, PS
4. **Team member (Scientists & Staff):** Dr. Roshan Zamir DCS, Dr. Syed Azam Shah PS, Mr. Yasir Ali RA, Muhammad Tariq PSA, Mustaqeem Shah G. Attendant.
5. **Overall Project Objective (es):** To investigate the effect of fumigants, biofumigants and biochar on plant vigor, growth of peach under replant condition in nurseries.
6. **Specific Objective (If any):** To study the performance of biochar on peach nursery plants.
7. **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.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** New Project
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** N/A
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):** (July 2021-June 2022)

Project title	PI & Co-PI	Funding agency/total budget/starting & completion dates
Sustainable Approach for Effective Control of Peach Stone Replant Disorders	Mr. Shahid Akbar Khalil, PS/PI Dr. Roshan Zamir, DCS/Co-PI	PSF/Rs. 2.8 millions/ 01.09.2022 – 31. 08.2025

   d. **Submitted funded project:** Nil
   e. **Published Research Paper:** Nil
   f. **Event organized (As PI/Co-PI:** Nil

9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023**
    i. The soil will be tested for organic matter, pH, electric conductivity, total nitrogen, soil carbon and microbial biomass before adding of biochar to the soil
    ii. The experiment will be laid out in a randomized complete block design with four treatments and five replications.
    iii. Biochar will be added to the soil @ 0, 15, 20, 25 kg subplot^{-1} and mixed together through with rotavator/rotary hoe.
    iv. Initial observations on percent germination, height of the seedlings, girth of the seedlings and number of leaves will be recorded.
11. **Expected Output from the Next Year Planned Research Work:** Detoxify land will be available for stone fruit nursery growers
12. **Expenditure and Requirements:** Provided in the 1st project

Project #: 04

1. **Project Title:** Evaluation of newly developed wheat genotypes in station and out-station trials for yield and yield related traits
2. **Funding Type:** PAEC/WPEP
3. **Principal Investigator:** Dr. Muhammad Irfaq Khan, PS (Group Leader)
4. **Team members (Scientists & staff):**
    - Dr. Syed Tariq Shah, PS
    - Mr. Muqeem Jan (General Attendant)
    - Mr. Zia ul Haq (SA-IV)
5. **Overall Project Objectives:** Development of improved wheat varieties for commercial cultivation in KP under irrigated conditions
6. **Specific Objective:** BNS seed production of NIFA's irrigated varieties and evaluation of elite breeding material for further selection
7. **Background and Justification:** To increase per hectare yield on farmers' fields, varietal development to cope with existing environmental conditions and prevailing diseases is indispensable. For this purpose, consistent efforts are being made at NIFA through the utilization of conventional / non-conventional breeding techniques and released 04 varieties (Bakhtawar, Fakhre Sarhad, Bathoor and NIFA Aman) coupled with developing a number of potential genotypes that are at pre-released stage for irrigated areas.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
    a. **Research findings:**
        i. Two genotypes Viz. CTHN-172114 (1st year) and CTHN-162056 (2nd year) were contributed for mandatory evaluation in National Uniform Wheat Yield Trials (NUWYT). Genotype CTHN-172114 stood 1st (4667 kg ha^{-1}) on Khyber Pakhtunkhwa (KPK) level and acquired yield of 4667 kg ha^{-1}in comparison to standard check Pakistan 2013 (4383 kg ha^{-1}) while it stood in top ten (4153 kg ha^{-1}) with RRI of 8.83 against yellow rust (*Yr*). Genotype CTHN-162056 performed well on KPK level (4181 kg ha^{-1}) in comparison with two standard checks (3859-4114 kg ha^{-1}) having percent increase over mean grain yield of +1.94 On country level, it yielded 4056 kg ha^{-1} and RRI of ≈6 against *Yr* .
        ii. Four high yielding genotypes (CT-18048, CT-18062, and CT-18145) were contributed for Khyber Pakhtunkhwa Wheat Yield Trials (KPWYT). According to the results on 13 locations in the province, CT-18062 stood 2nd on

provincial level by acquiring average grain yield of 3719 kg ha^{-1} with an increase of 9.4% over high yielding check Gulzar-19 (3398 kg ha^{-1}).

iii. Nineteen genotypes including 3 checks were evaluated in micro-plot trial (MPT). Based on statistically significant higher grain yield and disease response to *Yr*, four of them (4022-4233 kg $ha^{-1)}$ were selected for further evaluation.

iv. Fifty two genotypes were evaluated in two sets of Advanced Yield Trials (AYTs) including checks. Based on significant higher yield in comparison to check cultivars and disease response, 23 genotypes (4444-5733 kg ha^{-1}) were selected for further evaluation.

v. Sixty genotypes were evaluated in 03 sets of Preliminary Yield Trials (PYTs) including check cultivars. Based on significant higher yield in comparison to check cultivars and disease response, 43 genotypes were selected for further evaluation.

vi. Twenty advance lines were evaluated in National Wheat Disease Screening Nursery (NWDSN), NARC, Islamabad and satisfactory report was received from the concerned quarter.

vii. BNS seed of NIFA Aman was produced through progeny rows and blocks.

viii. Seeds of NIFA genotypes included in NUWYT, KPWYT and MPT were multiplied on limited area.

ix. DDA Bunir was provided 200 kg seed of NIFA Aman on cash payment. They have reported a total of 01 ton production of NIFA-Aman on farmer's field. However, as per recent information from the authority, Lot Number has not been issued to the produce yet.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing funded Project (s) (PI/Co-PI): Nil

d. Awarded funded project: Nil

e. Published Research Paper: Fazle Subhan, Muhammad Irfaq Khan and Syed Tariq Shah. 2021. New high yielding and disease tolerant wheat (*Triticum aestivum* L) variety NIFA AMAN-2017 for irrigated areas of Khyber Pakhtunkhwa. Pure and Applied Biology. Vol. 11, Issue 2, pp. 523-530.

f. Conducted Event (As PI/Co-PI): Nil

g. Published Urdu/English articles in Newspapers: Nil

9. Training Received: Nil

10. Summary of the Planned Research Work for the Year July, 2022 - June, 2023:

i. Sixty six (66) genotypes will be evaluated in 03 sets of PYTs.

ii. Sixty (60) genotypes will be evaluated in 03 sets of AYTs.

iii. Twenty (20) genotypes will be evaluated in MPT.

iv. Approximately, 06 advance genotypes of NUWYT and KPWYT will be evaluated for distinctness, uniformity and stability (DUS) characters.

v. Approximately, 04 genotypes will be evaluated in KPWYT.

vi. Up to 02 genotypes will be sent for evaluation in NUWYT.

vii. Twenty (20) genotypes will be sent to CDRI, Islamabad, for inclusion National Wheat Disease Screening Nursery (NWDSN) for evaluation against *Yr*, *Lr* and *Sr*.
viii. Plantation of progeny rows and blocks of irrigated wheat varieties.
ix. Seed multiplication of about 26 genotypes included in NUWYT, KPWYT and MPT.

11. **Expected Output from the Next Year Planned Research Work:** Newly developed high yielding, disease resistant (against *Yr*) wheat genotypes will be evaluated in different station and out station yield trials. Based on their performance, suitable genotypes will be offered for release as commercial cultivars for irrigated areas of KPK. BNS of irrigated wheat varieties of NIFA will be produced for maintaining genetic purity of the existing irrigated wheat varieties.
12. **Expenditure and Requirements:** Please see at the end.

Project #: 05

1. **Project title:** Genetic improvement of irrigated wheat through hybridization and induced mutation
2. **Funding Type:** PAEC/WPEP
3. **Principal Investigator:** Dr. Muhammad Irfaq Khan, PS (Group Leader)
4. **Team members (Scientists & staff):** As mentioned in Project No. 1
5. **Overall Project Objectives:** Creation of new genetic variability for higher grain yield and disease resistance (*Yr*) through hybridization and induced mutation
6. **Specific Objective:** Selection of improved hybrid/mutants from segregating populations
7. **Background and Justification (3-5 lines):** Frequent changes in the climate have been observed for the last few years in the province/country and the crop is suffered with high temperature, early drought and water shortage. New races of wheat diseases have also been emerged. New high yielding varieties with tolerance to such biotic/abiotic stresses are intensely needed for cultivation in these areas. The ongoing research efforts (mutation and hybridization) at NIFA regarding development of genetically improved varieties have resulted in some advance lines with heat tolerance, early maturity and disease resistance to be released for commercial cultivation in near future.
8. **Main findings from the Previous Year (2021-22) Research Work:**

a. Research findings:

- **Hybridization**

i. Seventy seven (77) genetically variable genotypes were planted in the field as gene pool on two different dates. Six fresh cross combinations were successfully attempted.
ii. F_1/M_1 generation resulted from 11 cross combinations (irradiated with 100 Gy of γ rays) was successfully harvested for raising as F_2/M_2 population during the next cropping season.
iii. Thirty seven (37) desirable recombinants (disease resistant with high tillering capacity, medium plant height, early maturing and bold seeded) were selected from F_2 population resulted from 3 cross-combinations.
iv. Based on disease resistance, higher yield and early maturity; fifty seven (57) families out of 98 recombinants were selected from F_3 population resultant from 13 cross combinations.

v. Based on higher yield, early maturity and disease resistance, out of 34, 18 F_4 families were selected for further evaluation. The population was resultant from 05 cross combinations.

➢ **Mutation**

i. Fifty six (56) desirable mutants were selected from M_2 population resulted from the seed treatment of two varieties (Fakhr-e- Srahad and NIFA Bathoor-8) each with 200 and 300 Gy doses of gamma rays.

ii. Based on disease resistance and improved plant type, 26 promising mutants out of 78 were retained from M_3 population resulted from the seed treatment of Fakhr-e- Srahad and NIFA Bathoor-8, each with 250 and 350 Gy doses of gamma irradiation.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing funded Project (s) (PI/Co-PI): Nil

d. Awarded funded project: Nil

e. Published Research Paper: As in project #. 01

f. Conducted Event (As PI/Co-PI): Nil

g. Published Urdu/English articles in Zarat Nama/Newspapers/Radio talks: Nil

9. Training Received: Nil

10. Summary Planned Research Work for the Year July, 2022-June, 2023

a. Hybridization

i. About 60 genetically variable genotypes will be planted as gene pool on two to three different sowing dates for attempting approximately 05-06 fresh cross combinations during the flowering season.

ii. Seed of each of two varieties (NIFA Aman and NIFA Bathoor) will be irradiated with 300 Gy dose of gamma rays to be raised as M_1 generation.

iii. Seed from 06 successful F_0 cross combinations will be raised as F_1 generation in the field.

iv. F_2/M_2 segregating population resulted from 11 cross combinations already irradiated with 100 Gy gamma rays dose will be space planted in the field along with their respective parents as control for selection of desirable recombinants/mutants.

v. Thirty seven (37) selected recombinants will be raised on plant progeny basis as F_3 population resulted from three cross-combinations for confirmation of their desired hybridized traits.

vi. Fifty seven (57) F_4 recombinants will be planted in observation nursery (each in 02 rows, 1.5 m long) for confirmation of the genetic stability in their respective hybridized traits.

vii. Nine F_5 genotypes will be planted in observation nursery, each in two rows 1.5 m long for confirmation of the genetic stability in their respective hybridized traits.

b. Mutation

i. Fifty six (56) selected mutants (resulted from seed irradiation of two varieties with 200 and 300 Gy each) will be raised as M_3 population on plant progeny basis. The material will be observed throughout the growth period and only desired mutants will be retained for further evaluation.

ii. Twenty six (26) promising mutants will be raised as M_4 generation on plant progeny basis in order to confirm their respective mutated traits for higher yield and disease resistance.

iii. Nineteen (19) M_4 Mutants will be planted in observation nursery, each in two rows 1.5 m long for confirmation of stability in their respective mutated traits.

11. **Expected Output from the Next Year Planned Research Work:** Development of high yielding, disease resistant (*Yr*), and early maturing recombinants/mutants for evaluation and release as improved wheat varieties for irrigated areas of KP.
12. **Expenditure and Requirements:** Please see at the end

Project #: 06

1. **Project Title:** Evaluation of exotic wheat germplasm received from CIMMYT /CIB, CAS, China
2. **Funding Type:** PAEC/WPEP and Pak-China Project
3. **Principal Investigator:** Dr. Syed Tariq Shah, PS
4. **Team members (Scientists & staff):**
   - Dr. Muhammad Irfaq Khan, PS
   - Mr Muqeem Jan (General Attendant)
   - Mr. Zia ul Haq (SA-IV)
5. **Overall Project Objective (s):** Developing/evolving high yielding and disease resistant wheat varieties for agro-climatic condition of KP
6. **Specific Objective:** Development of genetically improved wheat genotypes through introduction/selection for further evaluation in NIFA Observation Nurseries and Yield Trials
7. **Background and Justification (3-5 lines):** Development of new high yielding, disease resistant and early maturing varieties are indefensible for boosting wheat yield in the province/country. Selection of improved wheat genotypes from exotic wheat germplasm are the pre-requisites for onward testing in different yield trials. The ongoing efforts have resulted several improved wheat genotypes that are now under trial in PYTs, AYTs and MPT to be developed and released as improved varieties.
8. **Main findings from the Previous Year (2021-22) Research Work:**
   a. **Research findings:**
      i. **54th IBWSN** (International Bread Wheat Screening Nursery) consisting of **256** genotypes received from CIMMYT, Mexico, was evaluated for plant type, yield and disease reaction (*Yr*), a total of 37 genotypes were selected for further evaluation. The selected genotypes revealed statistically significant yield over the check varieties by producing grain yield in the range of 7067 - 9200 kg ha^{-1}.
      ii. **32nd HRWSN** (High Rainfall Wheat Screening Nursery) consisting of **116** genotypes received from CIMMYT, Mexico, was evaluated for plant type, yield and disease reaction (*Yr*), a total of 05 genotypes were selected for further evaluation. The selected genotypes revealed statistically significant yield over the check varieties by producing grain yield in the range of 7733 - 8267 kg ha^{-1}.
      iii. **42nd ESWYT** (Elite Spring Wheat Yield Trial) consisting of **50** genotypes was evaluated for yield and resistance against diseases (*Yr*) with local check NIFA AMAN. Nine genotypes were selected for further evaluation. The selected genotypes revealed statistically significant yield over the check variety NIFA AMAN (5167 kg ha^{-1}) by producing grain yield in the range of 5433 – 6167 kg ha^{-1}.
      iv. **09th WYCYT** (Wheat Yield Consortium Yield Trial) consisting of 33 genotypes was evaluated for yield and resistance against diseases (*Yr*) with

local check NIFA AMAN (5100 kg ha^{-1}). Two genotypes with statistically significant yield in the rage of 5300-5667 kg ha^{-1} and desirable disease response were selected for further evaluation.

v. **Pak-China Project** (Pak-China PYT) consisting of 04 genotypes was evaluated for yield and resistance against diseases (*Yr,)* with two local checks NIFA AMAN and Gulzhar-19. Three genotypes with higher yield and desirable disease response were selected for further evaluation in KPWYT (CIBW-2) and MPT (CIBW-4, 5). Quality analysis of CIBW-4 were carried out in NIFA having Zinc (Zn) 37 ppm and Iron (Fe) 59 ppm and in PINSTEC, Islamabad with results Zn 40 ppm and Fe 64 ppm.

vi. Genotypes CIBW-2, CIBW-4 and CIBW-5 were evaluated in NWDSN, NARC, Islamabad against yellow rust and were found resistant.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing funded Project (s) (PI/Co-PI):

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Cooperative agreement for mutual trial planting of wheat varieties between CIB, CAS, China and NIFA, Pakistan	PI: Dr. Syed Tariq Shah, PS	CIB, CAS, China /2600 US dollar for year, 2021-22/ January, 2021 to December, 2025 (05 year duration)

d. Awarded funded project: Nil

e. Published Research Paper:

Fazle Subhan, Muhammad Irfaq Khan and Syed Tariq Shah. 2021. New high yielding and disease tolerant wheat (*Triticum aestivum* L) variety NIFA AMAN-2017 for irrigated areas of Khyber Pakhtunkhwa. Pure and Applied Biology. Vol. 11, Issue 2, pp. 523-530.

f. Conducted Event (As PI/Co-PI): Nil

g. Published Urdu/English articles in Zarat Nama/Newspapers/Radio talks: Nil

9. Training Received:

Title	Period	Place
QMS requirements and implementation course	2-3/08/2021	NIFA, Peshawar

10. Planned Research Work for the Year July, 2022-June, 2023

i. International nurseries / trials i.e. 55th IBWSN, 33th HRWSN, 43th ESWYT and 10th WYCYT are expected to be received from CIMMYT. The trials will be planted as per mentioned layout and instructions. Data regarding plant type, height (cm), days to heading/maturity, lodging, biological yield, grain yield, disease resistance and other agronomic traits will be recorded for individual entries.

ii. Genotype CIBW-2 from Pak-China project will be evaluated in KPWYT and CIBW-4, 5 in Micro-Plot Trial (MPT) at NIFA. New wheat germplasm (5-10) may be expected from CIB, CAS, China. The material received from the project will evaluated accordingly to the provided plan.

11. Expected Output from the Next Year Planned Research Work:

Desirable genotypes will be selected for further evaluation (yield & disease resistance) in Preliminary and Advanced Yield Trials (PYT's and AYT's).

12. Expenditure and Requirements:

Expenditure (2021-22)

S. #.	Item	Quantity/#	Apro. Expend. (Rs)
1	DAP (50 kg bags)	04	24400
2	UREA(50 kg bags)	08	14160
3	SOP(50 kg bags)	04	22000
4	Zinc (03 kg bags)	04	4000
5	Fumigants (16 tubes) in a box	02	3000
6	DPL (350 man-days)	350 man days	175000
7	POL (Petrol+ Mobil Oil) for rotary hoe, ploughing & threshing	10000/ acre	40000
8	Miscellaneous (paper bags + Misery ban + Sutli + Plastic bags)	--	10000
9	Fungicides (Hombre)	03	4500
10	Tractor charges @Rs.25250/acre	04	101000
		Grand Total	398,060

*. Information provided by the farm branch

** Left over store from the previous year's purchase from WPEP

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S. #.	Item	Quantity/#	Apro. Expend. (Rs)
1	DAP (50 kg bags)	04 (12880/bag)	51520
2	UREA(50 kg bags)	08 (2300/bag)	18400
3	Zinc (03 kg bags)	04 (1036/bag)	4144
4	Fumigants (16 tubes) in a box	02 (1600/box)	3200
5	DPL (350 man days)	350 man days	175000
6	POL (Petrol+ Mobil Oil) for rotary hoe, ploughing & threshing	15000/acre	60000
7	Miscellaneous (paper bags + Misery ban + Sutli + Plastic bags)	--	16000
8	Fungicides (Hombre)	03	4800
9	Tractor charges @Rs.20000/acre	04 acres	80000
		Grand Total	413,064

Project #: 07

1. **Project Title:** Breeding high yielding okra (*Abelmoschus esculentus* L.) genotypes through induced mutations/selection and cross breeding techniques
2. **Funding Type:** PAEC
3. **Principal Investigator:** Dr. Syed Tariq Shah, PS
4. **Team members (Scientists & staff):**
   - Dr. Roshan Zamir, DCS
   - Mr. Mujahid Hamid (SA-1)

5. **Overall Project Objectives:** Development of high yielding okra genotypes for commercial cultivation in KP
6. **Specific Objective:** Nil
7. **Background and Justification (New Project) :** Okra (*Abelmoschus esculentus* L.) commonly called as Bhindi is an important warm season vegetable used in large quantities as well in a variety of ways in daily diets of the Sub-Continent including Pakistan. In Pakistan, okra is grown on an area of 15.58 thousand hectares with a total production of 117 thousand tons and average yield of 7569 kg ha^{-1} (FAO, 2019-20). To cover this area, major portion of seeds including hybrids are imported from abroad especially India and China at the expense of national exchequer. This is mainly because few national commercial okra varieties are available in the country without proper seed production.

   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. To address these problems the proposed project to breed okra genotypes best suited for cultivation under local growing conditions. The high yielding and consumer-preferred genotypes developed through the proposed project will play a significant role in fetching financial benefits to the growers and enhancing overall production of okra in KP. Informal okra germplasm evaluation has been initiated at NIFA, since April, 2020.
8. **Main findings of the Previous Year (2021-22)Work:** Nil
   a. **Crop variety/ Patent/ Lab Accreditation/Product certification by authorized department:** Nil
   b. **Ongoing funded Project (s) (PI/Co-PI):** Nil
   c. **Awarded funded project:** Nil
   d. **Published Research Paper:** Nil
   e. **Conducted Event (As PI/Co-PI):** Nil
   f. **Published Urdu/English articles in Newspapers:** Nil
9. **Training received:**

Title	Period	Place
QMS Requirements & Implementation Course	2-3/08/2021	NIFA, Peshawar

10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    i. 20 genotypes will be evaluated in a replicated yield trial at NIFA.
    ii. Selected okra genotype NBL-1 along with local check will be evaluated in multi-location yield trials in KP.
    iii. Genetic variability through induced mutation and hybridization will be carried out for higher yield.
11. **Expected Output from the Next Year Planned Research Work:**
    i. Selection from germplasm
    ii. Adaptability and stability evaluation of selected lines
    iii. Generation of segregating material to raised M_2/F_2 population
12. **Expenditure and Requirements:**

    Expenditure (2021-22): Nil

    Requirements (2022-23)

    (Provision of requirements will depend on availability of funds)

S.No	Item	Quantity/#	Apro. Expend. (Rs)
1	DAP (50 kg bags)	01 (12880/bag)	12880
2	UREA (50 kg bags)	01 (2300/bag)	2300

3	Pesticides	5 bottles	5000
4	DPL (300 man days)	300 man days	150000
5	POL (Petrol+ Mobil Oil) for rotary hoe, ploughing & threshing	15000/acre	4000
6	Miscellaneous (paper bags + Misery ban + Plastic bags)	--	10000
7	Tractor charges @Rs.20000/acre	0.5 acre	5000
		Grand Total	189,180

Project #: 08

1. **Project Title:** Wheat improvement for rainfed areas of Khyber Pakhtunkhwa
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Dr. Farooq-i-Azam, Principal Scientist
4. **Team member Cooperating Scientist(s):**
   - Dr. Akhtar Ali, SS
   - Dr. Salman Ahmad, SS
   - Mr. Muhammad Tariq, Res. Associate
   - Mr. Muhammad Onais, SA-II
   - Mr. Muhammad Arshad, SA-III
5. **Overall Project Objectives:** Development of wheat cultivars / genotypes with enhanced grain yield, drought tolerance and disease resistance
6. **Specific Objective (If any):** Identification and selection of wheat genotypes for yellow and leaf rust resistance, lodging resistance, shattering resistance good chappati making quality.
7. **Background and Justification:** Sixty percent wheat cultivated area in Khyber Pakhtunkhwa (KP) comes under rainfed conditions. NIFA has released 06 high yielding and disease resistant rainfed wheat varieties (Tatara, Takbeer, NIFA Barsat 2010, NIFA Lalma 2013, NIFA Insaf 2015 and NIFA Awaz 2019) 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.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Conducted DUS of 03 candidate wheat lines NRL 1664, NRL 1812 & NRL 1825
      ii. Contributed 02 candidate lines (NRL 1812 and NRL 1825) to NUWYT. NRL 1812 produced 5%, 9% and 25% higher grain yield than Pakistan 2013 on Pakistan, KP and AJK basis under rainfed conditions. Under irrigated conditions it out yielded the checks by 40% and 47% on Gilgit and Baluchistan basis respectively.
      iii. Contributed 05 elite lines (NRL 1901, NRL 1903, NRL 1908, NRL 1928 and NRL 1929) to KPWYT. NRL 1929 ranked 05th by producing yield of 3411 kg ha^{-1} with 12% yield increase over PS-19 and 20% over local check.

iv. Contributed 16 wheat lines to National wheat disease screening nursery (NWDSN). Five lines i.e., NRL 2001, NRL 2006, NRL 2008, NRL 2026 and NRL 1812 have desirable ACI for yellow and leaf rust.
v. Thirteen lines were selected from PYT's. Selected lines produced GY > 4911 $kgha^{-1}$.
vi. Five lines were selected from NBPYT's. Selected lines produced GY > 4578 $Kgha^{-1.}$
vii. Six wheat lines were selected from AYT. Selected lines produced GY > 4000 $Kgha^{-1}$.
viii. A total of 212 progeny blocks and 210 progeny rows of NIFA Awaz 2019, NIFA Lalma 2013, NIFA Insaf 2015 and Tatara were selected.
ix. 253000 kg certified seed of Lalma, Awaz and Insaf is produced by DDA Buner

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing funded Project (s) (PI/Co-PI): (July 2021 – June 2022): Nil

d. Awarded funded project: (July 2021 – June 2022): Nil

e. Published Research Paper: Nil

f. Conducted Event (As PI/Co-PI):

Event title	PI or Co-PI
Seed Day 2022	PI

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July, 2022 - June, 2023:

i. Sixty newly selected genotypes including check will be evaluated in 05 Preliminary yield trials.
ii. Twenty promising wheat lines including check will be evaluated in 02 Advanced yield trials.
iii. Five elite wheat lines will be tested in Khyber Pakhtunkhwa Wheat Yield Trial.
iv. Eighteen wheat lines will be contributed to National wheat disease screening nursery.
v. Five wheat lines will be screened for blast and stem rust in Bangladesh and Kenya.
vi. Two candidate wheat lines will be tested in National Uniform Wheat Yield Trial.
vii. Hundred progeny blocks each of NIFA Lalma 2013 and NIFA Awaz 2019 will be planted.

11. Expected Output from the Next Year Planned Research Work:

Five elite wheat lines (NRL 2001, NRL 2007, NRL 2009, NRL 2031 and NRL 2032) will be submitted to KPWYT and 02 candidate lines (NRL 1812 and NRL 1929) will be contributed to NUWYT. Proposal of NRL 1664 (Fakhre NIFA 2022) will be submitted to technical committee of provincial seed council.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Area (Acre)*	5.5	--
2.	DPLs	107	53500
3.	DAP, Urea, SOP, Zinc (bags)	4, 4,0, 0	31480
4.	Weedicides (bottles)	5	7500
5.	Cloth bags (old bags were used)	250	--
6.	Fumigation tablets (pack)	02	3000
7.	POL*	265 liters	42400
		Grand Total	137880

* Data provided by Farm management

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1.	Area (Acre)	05	--
2.	DPLs	250	125000
3.	DAP*, Urea** (bags)	5, 5	76440
4.	Weedicides (bottles)	10	15000
5.	Cloth bags	300	--
6.	Fumigation tablets (pack)	02	3000
7.	Fungicides for seed treatment (bottle)	02	3200
8.	POL	350 liters	85400
		Grand Total	308040

*DAP: @ Rs. 12880/bag, **Urea: @ Rs. 2408/bag

Project #: 9

1. **Project Title:** Screening and evaluation of exotic/local wheat nurseries and trails under rainfed conditions
2. **Funding Type:** PAEC
3. **Principal Investigator:** Dr. Salman Ahmad
4. **Team Member:**
   - Dr. Farooq-i-Azam, PS
   - Dr. Akhtar Ali, SS
   - Mr. Muhammad Tariq, Res. Associate
   - Mr. Muhammad Onais, SA-II
   - Mr. Muhammad Arshad, SA-III
5. **Overall Project Objectives:** Development of high yielding, disease resistant and drought tolerant wheat germplasm and varieties
6. **Specific Objective (If any):** Selection of high yielding, disease resistant and drought tolerant wheat genotypes for further evaluation and confirmation in preliminary yield trials.
7. **Background and Justification:** Evaluation of the advanced and elite genotypes under rainfed conditions leads to identification and development of wheat germplasm adapted to local production environments with enhanced tolerance to various abiotic and biotic stresses. Such efforts culminate in the release of new high yielding, disease resistant and widely adapted varieties to be used by the farming community.
8. **Main findings of the Previous Year (2021-22) Work:**

   a. Research findings:

   i. In 39th Semi-Arid Wheat Screening Nursery, 256 wheat genotypes were planted. Based on high yield and yellow rust resistance 26 wheat genotypes were selected.

   ii. In 29th Semi-Arid Wheat Yield Trial, 50 elite wheat lines were planted. Sixteen performing (>5000kg ha^{-1}) and disease resistant elite wheat lines were selected.

   iii. In 11th Stress Adaptive Yield Trial Nursery, 40 elite wheat lines were planted. Sixteen outstanding lines were selected based on high yield (>5000kg ha^{-1}) and disease reaction.

iv. In 4th NIFA Wheat Observation Nursery, 227 genotypes from advance generations were planted. Based on field performance 18 wheat genotypes were selected.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing/awarded funded Project (s) (PI/Co-PI): Nil

d. Submitted funded project: Nil

e. Published Research Paper: Nil

f. Event Organized (As PI/Co-PI): Nil

9. Training Attended:

Title	Period	Place
QMS Requirements & Implementation Course	2-3/08/2021	NIFA
QMS Auditor Certification course	4-6/08/2021	NIFA
Application of GIS & Remote Sensing in Agriculture Sector	24-26/05/2022	PARD, Peshawar

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Exotic wheat nurseries and trials from CIMMYT/ICARDA will be received through Wheat Coordinator PARC, Islamabad and planted under rainfed conditions for screening and evaluation.

ii. NIFA Wheat Observation Nursery will be planted to evaluate the field performance of wheat genotypes selected from advanced generations of the local breeding programme.

iii. Experiment will be conducted under rainfed and irrigated conditions on six wheat genotypes including varieties and advanced lines to measure morpho-physiological traits in context to climate change.

11. Expected Output from the Next Year Planned Research Work:

i. Good performing wheat genotypes will be selected and utilized as such a source material in wheat hybridization as well as for variety developmental programme.

ii. DUS studies will be conducted for the upcoming candidate lines.

12. Expenditure and Requirements:

Already provided in Project "Wheat improvement for rainfed areas of Khyber Pakhtunkhwa"

Project #: 10

1. **Project Title:** Wheat breeding for disease resistance and moisture stress tolerance
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Dr. Akhtar Ali, Senior Scientist
4. **Team member Cooperating Scientist(s):**
   - Dr. Farooq-i-Azam, PS
   - Dr. Salman Ahmad, SS
   - Mr. Muhammad Tariq, Res. Associate
   - Mr. Muhammad Onais, SA-II
   - Mr. Muhammad Arshad, SA-III
5. **Overall Project Objectives:** Development of disease resistant wheat germplasm
6. **Specific Objective (If any):** Selection of desirable plants/progenies in segregating population for further evaluation.

7. **Background and Justification:** Wheat is the staple food crop of the people of Pakistan and essential for its food security. In the current scenario of climate change, stripe rust is one of the most devastating foliar diseases that poses continuous threat to wheat production. The capacity of rusts to develop into widespread epidemics is well documented. Hence domination of a single variety or varieties from the same genetic background are at risk. Frequent changes in disease virulence, in particular, yellow rust forced the breeders to develop more number of resistant varieties for sustainable wheat production. In such conditions diverse source of resistance are the only tools for rust management to ensure sustainable crop production. Therefore, regular efforts are underway to develop potential genotypes for higher yield potential, disease resistance and moisture stress tolerance.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Four fresh crosses were successfully attempted
      ii. 12 F_1 combinations were raised and seed was bulked harvested individually
      iii. 30 best plants were selected in F_2 Generation
      iv. 72 progenies were selected in F_3 Generation of 08 different combinations
      v. 68 best performing progenies were selected in 11 different combinations
      vi. Year 2021-22 was escaped year due to high temperature and low humidity. The disease appearance was very low.
      vii. 02 NIFA Wheat breeding lines (NBL 1910 and NBL1911) showed high level of resistance to yellow rust in NWDSN 2021-22
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing funded Project (s) (PI/Co-PI): (July 2021 – June 2022):** Nil
   d. **Awarded funded project: (July 2021 – June 2022):** Nil
   e. **Published Research Paper:** Nil
   f. **Conducted Event (As PI/Co-PI):** Nil
9. **Training attended: Nil**
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    a. Planting of crossing blocks consisting of desirable parents for new crossing
    b. Space planting of F_1 generation of 4 different combinations
    c. Space planting of F_2 generation of 12 combinations for desirable single plant selection
    d. Space planting of 30 F_3 progenies of 02 combinations along with respective parents for desirable selections
    e. Space planting of 72 F_4 progenies of 08 different combinations along with respective parents for desirable selections
    f. Testing of 68 best performing F_5 progenies of 11 combinations in non-replicated nursery along with checks for grain yield, disease resistance and agronomic traits
    g. Raising of M_1 generation
11. **Expected Output from the Next Year Planned Research Work:**
    Development of 60- 70 new disease resistant and high yielding genotypes with different genetic background for combating stripe rust under the emerging scenario of climate change in the province.
12. **Expenditure and Requirements:** Already provided in project "Wheat improvement for rainfed areas of Khyber Pakhtunkhwa".

Project #: 11

1. **Project Title:** Quality Wheat Seed Production
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Dr. Akhtar Ali, Senior Scientist
4. **Team member Cooperating Scientist(s):**
   - Dr. Farooq-i-Azam, PS
   - Dr. Salman Ahmad, SS
   - Mr. Muhammad Tariq, Res. Associate
   - Mr. Muhammad Onais, SA-II
   - Mr. Muhammad Arshad, SA-III
5. **Overall Project Objectives:** Wheat seed production enhancement of NIFA wheat varieties
6. **Specific Objective (If any):**
   i. To strengthen the quality seed production system of NIFA and enhance the availability of quality seed of improved wheat varieties.
   ii. Production of source seed (Pre-basic and basic) of NIFA release wheat varieties for government seed multiplication agencies and progressive growers.
7. **Background and Justification:** Wheat is the main staple crop and therefore essential for the food security of Pakistan. To enhance wheat productivity, quality seed production of improved wheat varieties is direly needed to benefit the farmers. In Khyber Pakhtunkhwa, formal seed industry, agricultural research, extension and couple of private seed companies are making efforts to provide wheat seed to the farming communities. However, they are hardly providing 15% seed (12000 metric tons) of the total wheat seed requirement. NIFA improved wheat varieties are popular in the farming community and therefore, quality seed production and dissemination will enhance the overall production of the province.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Temperature stress at grain filling stage affected seed production (10-20%) by reducing grain weight (2-4%)
      ii. 16.9 tons seed was produced and initially certified in Pre-basic class by FSC&RD official (unprocessed)
      iii. Seed rate (32 kg/acre) has resulted in higher multiplication factor by producing healthy plants and bold seed
      iv. DDA Buner played a pivotal role in NIFA wheat varieties seed production/ proliferation by producing 253,000 kg seed enough for cultivating 5000 acres
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing funded Project (s) (PI/Co-PI): (July 2021 – June 2022):** Nil
   d. **Awarded funded project: (July 2021 – June 2022):** Nil
   e. **Published Research Paper:** Nil
   f. **Conducted Event (As PI/Co-PI):** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    a. Wheat seed will be multiplied on 10 acres of land at NIFA
    b. Seed rate will be kept 32 kg/acre
11. **Expected Output from the Next Year Planned Research Work:** Approximate 14 – 15 tons quality seed will be produced

12. Expenditure and Requirements:

Expenditure (2021-22)

S#	Items	Quantity	Expenditure
1	Area	13 acres	
2	Urea	15 bags	26550/-
3	DAP	10 bags	61000/-
4	weedicide		58350/-
5	Harvesting items		72825/-
6	POL Charges		210000/-
7	DPLs (until August)	657 days	328500/-
		Grand Total	757225/-

* Data provided by Farm management

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S#	Items	Quantity	Expenditure
1	Area	7-8 acres	-
2	Urea	15 bags	36120/-
3	DAP	10 bags	128800/-
4	Weedicide		65000/-
5	Harvesting items		80000/-
6	POL Charges		250000/-
7	DPLs (until August)	657 days	328500/-
		Grand Total	888420/-

Project#: 12

1. **Project Title:** Breeding high yielding and large seeded mungbean genotypes through induced mutation and cross breeding techniques
2. **Funding Source Type:** PAEC and PSDP Pulses Project
3. **Principal Investigator:** Dr. Iqbal Saeed, PS
4. **Team members (Scientists & Staff):**
   - Dr. Gul Sanat Shah, DCS
   - Mr. Shahzad Ahmed, JS
   - Mr Nizam Shah, SA-II
   - Mr. Nasir Khan, SA-II
   - Mr. Anwar Ali, G. Attendant
5. **Overall Project Objective(s):** Developing/evolving high yielding mungbean varieties for agro-climatic conditions of KP
6. **Specific Objective (If any):** Quality seed production of NIFA's mungbean varieties and evaluation of breeding material for further selection.
7. **Background and Justification (If new project):** Mungbean is an important kharif season's crop grown on marginal lands with meagre external outputs applied to crop by growers. 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 3000-3500 hectares. Development of shiny black-seeded and high yielding mungbean varieties is need of the day to increase overall production of mungbean in KP in particular and the country in general.

8. Main findings from the Previous Year (2021-22) Work:

a. Research findings:

i. Eight out of 13 green-seeded genotypes produced significant (p≤0.05) higher seed yield of 1632 – 2028 kg ha^{-1} against check varieties Ramzan (1382 kg ha^{-1}) and NIFA Mung-19 (1479 kg ha^{-1}) evaluated in ALYT in kharif 2021 at NIFA.

ii. Twenty one out of 39 green-seeded genotypes produced significant (p≤0.05) higher seed yield of 1997 – 2361 kg ha^{-1} against average seed yield of check varieties Ramzan (1781 kg ha^{-1}), NIFA Mung-19 (1800 kg ha^{-1}) and AZRI Mung-18 (1743 kg ha^{-1}) evaluated in 03 sets of preliminary yield trials (PYTs) in kharif 2021 at NIFA.

iii. Two out of 13 black-seeded mungbean genotypes produced significant (p≤0.05) higher seed yield of 1960 and 1971 kg ha^{-1} compared with check varieties NIFA Mung Sikaram-21 (1784 kg ha^{-1}) and NIFA Mung Spinghar-21 (1828 kg ha^{-1}) evaluated in PYT in kharif 2021 at NIFA.

iv. Three out of 06 green-seeded genotypes produced significant (p≤0.05) average higher seed yield of 1722 to 1794 kg ha^{-1} compared with average seed yield of NIFA Mung-19 (1665 kg ha^{-1}) and AZRI Mung-18 (1611 kg ha^{-1}) evaluated in adaptation yield trial at ARS, Karak and AZRC, D.I. Khan.

v. Ninety five recombinant plants were picked individually cross-combination wise from F_1/M_1 generation derived from 04 cross-combinations.

vi. Two hundred and Seven and 172 single plants were selected based on seed color, better plant type and high grain yield from F_2/M_2 and F_3/M_3 generation, respectively derived from 09 different cross-combinations.

vii. Eleven different cross-combinations were successfully attempted at NIFA to create genetic variability for seed color, better plant type and high yield.

viii. Four hundred and ten kg pre-basic seed of Ramzan, NIFA Mung-19, NIFA Mung Sikaram-21 and NIFA Mung Spinghar-21 was produced and 130 kg pre-basic seed of NIFA Mung Sikaram-21 and NIFA Mung Spinghar-21 was sold to AED, KP for further multiplication at Kurram in kharif 2021. AED, KP produced 1240 kg basic seed of these varieties in kharif 2021 at Kurram.

b. Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing/awarded funded Project (s) (PI/Co-PI):

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Promoting research for productivity enhancement in pulses	-	PARC-PSDP/24.446 Million / Dec., 2019 to June, 2024 (05 year duration)

d. Submitted funded projects: Nil

e. Published Research Paper:

Gul Sanat Shah Khattak, Iqbal Saeed, Shahzad Ahmad and Muhammad Ibrar (2022). World's first black-seeded high yielding mungbean [*Vigna radiata* (L.) Wilczek] varieties 'NIFA Sikaram-21 and NIFA Spinghar-21'. International Journal of Applied & Experimental Biology 1(2): 67-73.

f. Event organized (As PI/Co-PI):

Event title	PI/Co-PI
Pulses (mungbean and common bean) Awareness Seminar at Kurram from 13 to 15 Sep, 2021.	PI

9. Training Attended: Nil

10. Summary of Planned Research Work for the Year July, 2022-June, 2023

i. Four green-seeded mungbean candidates' lines (NIFA Mung-7, NIFA Mung-8, NIFA Mung-9 and NIFA Mung-10) have been contributed to the NUYT in kharif 2022.

ii. Adaptation trial consisted of 08 green-seeded mungbean genotypes has been planted at ARS, Karak and AZRC, D.I. Khan in kharif 2022.

iii. Seventeen greens-seeded recombinants and mutants have been planted to evaluate for seed yield and its components in advanced lines yield trial at NIFA in kharif 2022.

iv. Fifty one green-seeded recombinants and mutants have been planted for evaluation for seed yield and its components in 03 sets of preliminary yield trials at NIFA in kharif 2022.

v. Seventeen black-seeded recombinants have been planted for evaluation for seed yield and related traits in advanced yield trial at NIFA in kharif 2022.

vi. Mungbean NUYT-2022 consisting of 20 entries has been planted at NIFA in kharif 2022.

vii. One hundred and Forty six plants have been planted kharif 2022 in F_2/M_2 generation derived from 11 different cross-combinations at NIFA to select single plants for seed color, plant type and high grain yield.

viii. Two hundred and seven and 172 single-plant-progeny-rows have been planted in F_2/M_2 and F_3/M_3 generation, respectively derived from 09 different cross-combinations at NIFA in kharif 2022 for further single plant selections for desired traits in kharif 2022.

ix. Crossing block consisting of 07 parents has been planted at NIFA in kharif 2022 to attempt different cross-combinations to create genetic variability for the mentioned traits

x. Two and a half acres area have been planted at NIFA with NIFA green and black-seeded mungbean varieties in kharif 2022 for quality seed production. Similarly 244 kg pre-basic seed of NIFA green and black-seeded mungbean varieties has been distributed to AED, KP for further multiplication in KP in kharif 2022.

11. Expected Output from the Next Year Planned Research Work: Development of mungbean breeding material for evolving high yielding green/black seeded mungbean varieties.

12. Expenditures and Requirements

Expenditures: (2021-22)

S#	Item	Man-days/ quantity	Expenditure. Rs.)
1.	DPLs-NIFA	40	20,000/-
2.	DPLs-PSDP Pulses project	300	202,500/-
3.	DAP-NIFA	06 bags	36,600/-
4.	Insecticides-PSDP pulses project	-	25,000/-
5.	Paper & cloth bags-PSDP pulses project	1500	60,000/-
6.	POL	-	25,250/-
7.	DPL (for farm work)	06	3,000/-
		Grand Total	372,350/-

Requirements: (2022-23)

S.#	Item	Mandays/ quantity	Expenditures (Rs.)
1.	DPLs-NIFA	40	20,000/-
2.	DPLs-PSDP Pulses project	300	202,500/-
3.	DAP-NIFA	06 bags	90,000/-
4.	Insecticides-PSDP pulses project	-	25,000/-
5.	Paper & cloth bags-PSDP pulses project	1500	60,000/-
		Grand Total	397,500/-

Project #: 13

1. **Project Title:** Breeding high yielding common bean genotypes through induced mutation and cross breeding techniques
2. **Funding Source Type:** PAEC and PSDP Pulses Project
3. **Principal Investigator:** Shahzad Ahmad, JS
4. **Team Members (Scientists & Staff):**
   - Dr. Gul Sanat Shah, DCS
   - Mr. Shahzad Ahmed, JS
   - Mr Nizam Shah, SA-II
   - Mr. Nasir Khan, SA-II
   - Mr. Anwar Ali, G. Attendant
5. **Overall Project Objective(s):** Evolving high yielding common bean varieties for agro-climatic conditions of the KP
6. **Specific Objective (If any):** Evaluation of selected lines in yield trials and creation of genetic variability to provide base material for future varieties development. Quality seed production of NIFA's common bean varieties.
7. **Background and Justification:** Common bean is an important spring/kharif pulses crop. No data regarding area and production is available in an official documents so far. As per local growers and agricultural official, it is grown as inter-crop in maize is scattered pocked of Upper-Swat, Upper-Dir, Shangla, Upper-Chitral and Upper-Hazara Division. Kurram is the only area where it is grown on wider area as sole crop. Billions of rupees are spent on its import each year, thus wasting a huge national exchequer. In order to increase national production common bean, development of high yielding varieties is of utmost importance.
8. **Main findings from the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. In kharif 2021, 03 (NCB-Tajaki, NCB-Watani, NCB-Kenya) out of 06 genotypes produced significant ($p \leq 0.05$) higher average yield of 2061-2149 kg ha^{-1} compared with check variety Himalaya-1 (1849 kg ha^{-1}) at 03 locations in Kurram in adaptation trial.
      ii. In spring 2022, 01out of 08 genotypes produced significant ($p \leq 0.05$) higher yield of 2587 kg ha^{-1} compared with highest check variety NIFA Lobia Red-22 (1913 kg ha^{-1}) in replicated yield trial at NIFA.
      iii. F_1/M_1 generation of 03 cross-combinations and M_1 generation of NCB-Afghani (25 & 50Gy), NIFA Lobia Red-22 (75 Gy), and NIFA Lobia Yellow-22 (100 & 125 Gy) was planted at NIFA in spring 2022. All recombinant-cum-mutant and M_1 plants were picked, threshed and bagged individually cross-combination and dose wise.

iv. To create new genetic variability for semi erect type, seed color and high yield, 04 new cross-combinations were successfully attempted at NIFA in spring 2022. All crossed pods were picked cross-combination wise.
v. Thirty two genotypes as germplasm were evaluated for the above mentioned traits and 05 genotypes were selected for use in induced mutation and hybridization for creation of genetic variability for the traits mentioned above.
vi. Similarly, 09 exotic genotypes as germplasm were evaluated for heat tolerance at NIFA and 03 genotypes were found to perform better.
vii. In case of seed production, 30 kg pre-basic seed of NIFA Lobia Red-2022 and 50 kg pre-basic seed of NIFA Lobia Yellow-2022 was produced in spring 2022 at NIFA. Out of which 20 and 40 kg pre-basic seed of NIFA Lobia Red-2022 and NIFA Lobia Yellow-2022, respectively was sold to AED, KP for multiplication in common bean growing areas of KP in kharif 2022.

b. Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department:

Two common bean varieties "NIFA Lobia Red-22 and NIFA Lobia Yellow-22" were approved by KP Seed Council on 20 January, 2022 for cultivation in Kurram and other common bean growing areas.

c. Ongoing/awarded funded Project (s) (PI/Co-PI): Nil

d. Submitted funded project: Nil

e. Published Research Paper: Nil

f. Event Organized (As PI/Co-PI):

Event title	PI/Co-PI
Pulses (mungbean and common bean) Awareness Seminars at Kurram from 13 to 15 Sep, 2021.	Co-PI

9. Tanning Attended:

Title	Period	Place
Training on "Office Procedures & management"	Sep 27 to Oct 01, 2021	PARD, Peshawar
36th Training Course on "use of nuclear and other techniques in food and agriculture research"	October 04 to 15, 2021	NIFA, Peshawar
International Pulses day Exhibition	Feb 02, 2022	NARC, Islamabad
Rabi Pulses Travelling Seminar 2021-22	Feb, 22 to March 9, 2022	17 places: KP, Punjab, Sindh, Baluchistan

10. Planned Research Work for the Year July, 2022-June, 2023

i. M_1 of NCB-Himalaya-1 (100, 200 and 300 Gy of γ rays) has been planted in Kurram in kharif-2022.
ii. Eight genotypes along with check varieties will be evaluated in replicated trail at NIFA in spring 2023.
iii. F_1/M_1 generation derived from 04 different cross-combinations and 54 single plant recombinant-cum-mutant in F_2/M_2 generation will be evaluated in spring 2023 at NIFA.
iv. To create genetic variability for traits mentioned above, crossing block comprising of 06 parents will be planted at NIFA in spring 2023 to attend various cross-combinations

v. M_1 of 01 parents (NCB Kurram Local @150 & 200 Gy of γ rays) will be planted at NIFA in spring 2023.
vi. New exotic/local genotypes as germplasm will be acquired and evaluated for desired traits at NIFA in spring 2023 to select suitable parents for induced mutation and hybridization.
vii. Quality seed of NIFA Lobia Red-22 and NIFA Lobia yellow-22 will be produced.

11. **Expected Output from the Next Year Planned Research Work:** Development of common bean breeding material for evolving high yielding common bean varieties for the agro-climatic conditions of KP.
12. **Expenditure and Requirements:**

Expenditures: (2021-22)

S#	Item	Mandays/ quantity	Expenditure.(Rs.)
1.	DPLs-NIFA	29	14,500/-
2.	DPLs-PSDP Pulses project	200	135,000/-
3.	DAP-NIFA	01 bag	6,100/-
4.	Insecticides-PSDP pulses project	-	10,000/-
5.	Paper & cloth bags-PSDP pulses project	500	20,000/-
6.	POL	-	5,000/-
7.	DPL (for farm work)	6	3,000/-
		Grand Total	193,600/-

Requirements: (2022-23)

S#	Item	Mandays/ quantity	Expenditures (Rs.)
1.	DPLs-NIFA	40	20,000/-
2.	DPLs-PSDP Pulses project	250	168,750/-
3.	DAP-NIFA	02 bags	30,000/-
4.	Insecticides-PSDP pulses project	-	25,000/-
5.	Paper & cloth bags-PSDP pulses project	1000	40,000/-
		Grand Total	283,750/-

Project #: 14

1. **Project Title:** Breeding heat tolerant and high yielding chickpea genotypes
2. **Funding Source Type:** PSF Chickpea Project
3. **Principal Investigator:** Dr. Iqbal Saeed, PS
4. **Team members (Scientists & Staff):**
   - Dr. Gul Sanat Shah, DCS
   - Mr. Shahzad Ahmed, JS
   - Mr Nizam Shah, SA-II
   - Mr. Nasir Khan, SA-II
   - Mr. Anwar Ali, G. Attendant
5. **Overall Project Objective(s):** To develop high yielding and heat tolerant chickpea genotypes under field conditions.
6. **Specific Objective (If any):** Screening of chickpea genotypes for physiological traits responsible for heat tolerance under field conditions.

7. **Background and Justification (If new project):** Chickpea is the major rabi pulse crop of Pakistan and the KP as well. Being cool season crop, an increase in temperature substantially affects overall performance of the crop leading to reduction in production. It is therefore needed to screen the already developed genotypes of chickpea for physiological traits conferring tolerance to heat under field conditions to identify better performing genotypes. These genotypes may be used as source material for developing future heat tolerant and high yielding varieties.
8. **Main findings from the Previous Year (2021-22) Research Work:**
   a. **Research findings:**
      i. Twenty advanced chickpea genotypes were evaluated for physiological traits for heat tolerance under field conditions i.e. membrane relative injury, net photosynthesis rate, and biological and grain yield at NIFA in rabi 2021-22 under PSF funded project.
      ii. Eight genotypes performed better for average percent membrane relative injury ranging from 26.1 to 45.9% compared with other genotypes (58.6 to 70.8%)
      ii. These eight genotypes also showed average higher net photosynthesis values of 17.8 to 21.3 µmol m^{-2} s^{-1} in comparison with other genotypes (11.1 – 13.4 µmol m^{-2} s^{-1}).
      iii. The eight genotypes also showed higher CTD ranging from 3.9 to 5.6 °C compared with other genotypes (0.8 to 1.4 °C).
      iv. The same eight genotypes also produced higher per plant grain yield ranging from 15.2 to 18.8 g $plant^{-1}$ compared with other genotypes (6.7 to 11.8 g $plant^{-1}$)
   b. **Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):**

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Breeding heat tolerant and high yielding chickpea genotypes	PI: Dr. Iqbal Saeed, PS Co-PI: Dr. Gul Sanat Shah, DCS	PSF/2.147 Million /Sep., 2020 to Aug., 2023 (03 year duration)

   d. **Submitted funded project:** Nil
   e. **Published Research Paper:** Nil
   f. **Event Organized (As PI/Co-PI):** Nil
9. **Training attended:** Nil
10. **Planned Research Work for the Year July, 2022-June, 2023**
    i. The better performing genotypes (08) for physiological traits and grain yield will be evaluated in replicated yield trial at NIFA and ARS, Karak
    ii. Data related to yield and yield components will be recorded on both sites.
11. **Expected Output from the Next Year Planned Research Work:**
    Identification of heat tolerant and high yielding chickpea genotypes for use as source material of favorable traits in hybridization and induced mutation for creation of genetic variability for the desired traits.

12. Expenditure and Requirements:

Expenditures: (2021-22)

S#	Item	Man-days/ quantity	Expenditure. (Rs.)
1.	DPLs-NIFA	20	10,000/-
2.	DPLs-PSF chickpea project	150	75,000/-
3.	DAP-NIFA	01 bag	6,100/-
4.	Insecticides-PSF chickpea project	-	40,000/-
5.	Paper & cloth bags-PSDP pulses project	200	20,000/-
6.	POL	-	5,000/-
7.	DPL (for farm work)	6	3,000/-
		Grand Total	159,100/-

Requirements: (2022-23)

S#	Item	Mandays/ quantity	Expenditures (Rs.)
1.	DPLs-NIFA	20	10,000/-
2.	DPLs-PSF chickpea project	150	75,000/-
3.	DAP-NIFA	01 bag	6,100/-
4.	Insecticides-PSF chickpea project	-	40,000/-
5.	Paper & cloth bags-PSDP pulses project	200	20,000/-
		Grand Total	151,100/-

Project #: 15

1. **Project Title:** Genetic improvement of oilseed brassicas through induced mutations and hybridization techniques
2. **Funding Type:** PAEC
3. **Principal Investigator:** Hafiz Munir Ahmed, PS
4. **Team Members:**
   - Khurshid Ahmad, SS
   - Abdul Haseeb Durani, SSA
   - Wisal Khan, SA-III
5. **Overall Project Objectives:** Development of high seed and oil yielding rapeseed & mustard varieties
6. **Specific Objectives:**
   i. Stress tolerance
   ii. Wider adaptability
   iii. Improved oil quality
7. **Background and Justification:** Pakistan is facing chronic edible oil shortage. Domestic production of edible oil from all traditional and non-traditional oilseeds is hardly meeting 12% of the requirement, rest is managed through imports. This puts additional financial pressure on the national exchequer. Rape and mustard, collectively referred to as Brassica oilseeds, are the second important source of vegetable oil and is contributing about 17% to domestic edible oil production. This project was started at NIFA to develop high seed and oil yielding, stress tolerant. Oilseed group at NIFA so far has contributed 04 rapeseed and 01 mustard improved varieties in the KP agricultural system.

8. Main findings of the Previous Year (2021-22) Work:

a. Research findings:

i. 05 rapeseed mutant/recombinants were contributed in the National Rapeseed Yield Trial, RM-1-9, RR-8-2 and RM-1-2 out yielded check by 2 – 9.5% in seed yield on overall mean of sixteen locations.

ii. 05 of eight rapeseed recombinants performed better (2098 – 2291 kg/ha) than check (2080 kg/ha) in zonal trials on average mean basis of six locations.

iii. In four set of advanced yield trials; 17 of 34 rapeseed/mustard rec./mutants exhibited better seed yield while only one genotype produced significantly higher seed yield (2269 kg/ha) than check (2082 kg/ha).

iv. As an important errand of breeding programme; breeding generations (F_1 – F_5/M_1 – M_5) were maintained in quest of creating genetic variability, selection of the desirable variants based on agronomic, quality traits and subsequence advancement of generations to achieve genetic stability leading.

v. First year DUS studies of two lines, one each of rapeseed and mustard was executed at NIFA with the cooperation FSC&RD, Regional Office, Peshawar.

vi. NIFA Sarson-T20: Approx. 200 kg seed was certified in Basic category.

b. Crop Variety /Patent/Lab Accreditation/Product Certification by the Authorized Department: Nil

c. Ongoing/awarded funded project (s) (PI/Co-PI): (July 2021–June 2022)**:** Nil

d. Submitted funded project: July 2021 – June 2022)

Project title	PI & Co-PI	Funding agency/total budget/starting & completion date	Status
Development of High Yielding Rapeseed Mutants Adaptable to Rain-fed Areas in KP through Nuclear Intervention (CS379)"	PI: Hafiz Munir Ahmed, PS Co-PI: Dr. Azam Shah, PS	ALP/3.2 million/subject to approval (3 yrs-proposed)	Approved

e. Published Research Paper:

Ahmed, H. M. and K. Ahmad (2022). Development of a new oilseed rape variety NIFA Sarson-T-20 through physical mutagenesis. Pak. J. Agri., Agri. Engg., Vet. Sci., 2022, 38 (1): 24-30.

سرسوں کی اہمیت اور اسکی پیداواری صلاحیت کا حصول - زراعت نامہ (ستمبر-2021)۔ کے-پی- کے

تحریر: حافظ منیراحمد، خورشید احمد

f. Event organized (as PI/Co-PI): Nil

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July, 2022 – June, 2023:

i. 04 rapeseed rec. /mutants will be contributed to NUYT for first year mandatory evaluation to assess the adaptability and seed yield potential of NIFA candidate lines across under diversified environmental conditions of Pakistan.

ii. Adaptation/multi-location seed yield trials consist of 03 mustard and 13 rapeseed genotypes will be planted at six locations in the KP (NIFA-Peshawar,

BARS-Kohat, AZRC- DI Khan, ARI, Swat and ARS, Buner) for agronomic evaluation of high yielding rapeseed and mustard mutant/recombinant lines.

iii. 41 rapeseed and 04 mustard rec. /mutant selected on the basis of high seed yield will be evaluated for agronomic performance in 04 Preliminary Yield Trials (PYT).
iv. For maintenance of released varieties; 20 progeny rows and 20 progeny blocks of each four rapeseed and mustard varieties will be planted
v. Variety grain of Durr-e-NIFA and Abasin-95 will be produced through filling plantation.
vi. Pre-basic and Basic class of seeds of NIFA Sarson-T20 and NIFA Gold will be produced.
vii. Second year Distinctive, Uniformity and Stability (DUS) studies of RR-8-2 & MM-31-5 is also planned in collaboration with FSC&RD.
viii. Submission of a newly developed rapeseed candidate variety proposal to TSC of PSC of the KP.

11. Expected Output from the Next Year Planned Research Work:

The whole project encompasses series of breeding activities aiming to ultimate development of high seed and oil yielding rapeseed varieties with improved quality.

12. Expenditure and Requirements:

Expenditure (2021-2022)

S#	Item	Quantity#	Expenditure(Rs.)
1	Urea (bag)	02	3600/-
2	NPK (bag)	02	10300/-
3	Field tags (No.)	1000	3000/-
4	Plastic Bags	50	1000/-
5	POL *	3 acre	29000/-
6	DPL *	303	151500/-
		Grand Total	198,400/-

*as per farm branch record

Requirements (2022-2023)

S#	Item	Quantity#	Approx. Expend. (Rs.)
1	Urea (bag)	03	6000/-
2	NPK (bags)	01	8000/-
3	Field tags 2”x3”	2000	4000/-
4	PP bags for seed 50kg	100	2000/-
5	Paper reem A4	04	2500/-
6	Brown paper bag 4”x3”	2000	5000/-
7	Brown paper bag 7”x5”	2000	8000/-
8	Tag rings	2kg	2000/-
9	Land	2.5+1 acre	-
10	DPL*	350	175,000/-
11	POL*	3.5 acre	30000/-
		Grand Total	242,500/-

** Approx. values

Project #: 16

1. **Project Title:** Induction, Manipulation of Genetic Variability and Quality Profiling of Oilseed Brassicas
2. **Funding Type:** PAEC

3. **Principal Investigator:** Khurshid Ahmad, SS
4. **Team Members:**
   - Hafiz Munir Ahmed, PS
   - Abdul Haseeb Durani, SSA
   - Wisal Khan, SA-III
5. **Overall Project Objectives:**
   Induction, identification and selection of genetically improved oilseed brassica genotypes for agronomic and quality traits
6. **Specific Objectives:**
   i. High oil contents
   ii. Low GSL and erucic acid
7. **Background and Justification:** Quality tests of oilseeds are conducted to determine the suitability of a genotype for the various uses of its products. The quality of oilseed crop is not a simple character, and is often not easy to determine. Therefore several different tests have to be conducted for which sophisticated equipments may be needed for speedy and reliable results. Near Infrared Reflectance Spectroscopy (NIRS) due to rapid, cost-effectiveness and non-destructive characteristics is the method of choice for quality assessment of oilseeds.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. In zonal trial; 03 entries exhibited substantially high oil content (46 – 48%) and one showed better GSL (55.6 µ mol g^{-1}) compared to control (oil 44.9% & GSL 62.7 µ mol g^{-1})
      ii. In AYTs; 33 entries showed high oil contents (46 – 49%) and 32 exhibited better profile of GSL (19 - 50 µ mol g^{-1}) while 25 test entries had reduced erucic acid (5 – 20%) than control (oil 45%; GSL 60 µ mol g^{-1} & EA 21%)
      iii. In early breeding generation (mutant) M_2 and M_3; 90 genotypes showed high oil contents (oil 46 – 50%); 61 had reduced GSL (13 – 65 µ mol g^{-1}) than parents (oil 44 – 46% & GSL 45 µ mol g^{-1} - 66 µ mol g^{-1}) and showed EA 7 – 25% .
   b. **Crop Variety /Patent/Lab Accreditation/Product Certification by the Authorized Department.** Nil
   c. **Ongoing Funded Project (s) (PI/Co-PI):** Nil
   d. **Submitted Funded Project:** Nil
   e. **Published Research Paper:**
      Ahmed, H. M. and K. Ahmad (2022). Development of a new oilseed rape variety NIFA Sarson-T-20 through physical mutagenesis. Pak. J. Agri., Agri. Engg., Vet. Sci., 2022, 38 (1): 24-30.

      سرسوں کی اہمیت اور اسکی پیداواری صلاحیت کا حصول-زراعت نامہ (ستمبر-2021)۔ کے-پی-کے

      تحریر: حافظ منیر احمد، خورشید احمد
   f. **Conducted Event (as PI/Co-PI):** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022 – June, 2023:**
    i. All early and advanced breeding materials of oilseed brassica planted in various trials will be subjected to oilseed quality analysis during 2022-23 for reconfirmation of the quality profile of the yield base selected material.

ii. 14 M_4; 41 F_4; 46 F_3/M_3 and 126 F_2/M_2 families and single plant progenies will be advanced to next generations to achieve genetic stability through further desirable selections based on agronomic traits.
iii. F_{1-2} of 04 cross combinations and M_{1-2} of 01 genotype will be planted for potential single plant selection based on yield and yield contributing traits.
iv. F_1 of 15 cross combinations and M_1 from irradiating one/two rapeseed genotypes will be developed for continuousness in developing diversified genetic stock for oilseed brassica breeding programme.

11. Expected Output from the Next Year Planned Research Work:

The creation of genetic variability through induced mutation, hybridization, selection and identification of desirable genotypes with modified quality traits will be major source of development of brassica superior genetic stocks.

12. Expenditure and Requirements:

Expenditure (2021-2022)

Requirements (2022-2023)

12 combined expenditure and requirements as given in project 01*

PLANT PROTECTION DIVISION

Project #: 01

1. **Project Title:** Epidemiology of invasive and non-invasive pathogens of wheat, aphids, resistant genes/sources and chemical control.
2. **Funding Type:** PAEC
3. **Principal Investigator:** Dr. Syed Jawad Ahmad Shah, DCS
4. **Team members (Scientists & Staff):** Mr. Usman Khaliq JS, Mr. Manzoor Shah PSA and Mr. Asif SA-III
5. **Overall Project Objectives:** To investigate important local pathogen virulence's, aphids and their adoption to wheat crop and post-harvest seed health issues.
6. **Specific Objective (If any):** Detection of yellow virulence's, effective genes/sources, chemical control and post-harvest seedborne diseases risk analyses.
7. **Background and Justification (If new project):** Epidemic prone wheat diseases include yellow rust, leaf rust and stem rust which are caused by airborne obligate fungi. Yellow rust caused by Puccinia striiformis f.sp. tritici (Pst) is a high-profile disease and its severe epidemics were reported in Pakistan. Thus, pathometry over time and space, information on the virulences dynamics of Pst meta-populations, adaptation of virulences to host genes/cultivars and deciphering and deployment of slow rusting wheat in the source area alongwith chemical control are crucial for minimizing rust epidemics and losses.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Four *Pst* races were detected in local pathogen population & virulence's were fixed for nine *Yr* resistance genes while other 14 *Yr* resistance genes were found effective during the season.
      ii. Preliminary study showed that yellow rust control can be achieved by using fungicides "Tillet".
      iii. One thousand & sixty released, candidate and elite wheat varieties were tested against locally diseases.
      iv. Post-harvest risk of black point and karnal bunt towards seed health of 180 commercial wheat varieties was achieved.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** NA
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI) :(**July 2021-June 2022): Nil
   d. **Submitted funded project:** (July 2021-June 2022): Nil
   e. **Published Research Paper:**
      i. Jing Feng, Jian Lu Sun, Shah SJA, Fengtao Wang, Qiang Yao, Qingyun Guo, Ruiming Lin, Shichang Xu. (2022) Identification of a stripe rust resistance gene YrSF in Chinese wheat (Triticum aestivum) landrace Sifangmai. Plant Breeding First published: 05 May 2022 https://doi.org/10.1111/pbr.13025 [Impact factor:2.536]
      ii. Wang M, Xu M, Wang F, Shah SJA, Feng J, Lin R, Xu S (2021) Characterization and validation of QTLs for adult plant stripe rust resistance in Chinese wheat landrace Dabaimai. Cereal Research Communications. 49:91-98. [Impact factor:1.240]
      iii. Gul T, Shah SJA and Jahan R (2021) Variability and control of apple scab fungus. LAP LAMBERT Academic Publishing, Germany. 50pp.

iv. Khalique, U., M. Zahid, N. Fatima, Shah SJA (2021) Evaluation of Pakistani wheat against aphid, Schizaphis graminum (Rondani) under favourable weather conditions in Peshawar, Pakistan. Journal of Innovative Sciences,7(2): 215-221.

f. Conducted Event (As PI/Co-PI): Nil

9. Trainings attended: Nil

10. Summary of the Planned Research Work for Year July, 2022-June, 2023:

i. A set 220 wheat genotypes to detect, identify different local pathogens and aphid infestation and their adoption levels to host.
ii. A set of 100 plus yellow rust differentials will be raised as trap nursery for virulence analyses and identification of effective genes.
iii. A set of 100 plus registered/approved Pakistani wheat cultivars will be tested for durable yellow rust resistance.
iv. Under national wheat improvement program, National Wheat Disease Screening Nursery (NWDSN) consisting of 500-600 will be tested for resistance against major diseases and aphid infestation.
v. A set of 70-80 candidate varieties will be tested for resistance against major diseases and aphid infestation.
vi. Rust differentials (100 plus genotypes) seed will be increased for continuity of the program.
vii. Post-harvest seed diseases (i.e. Karnal bunt & black point) of selected wheat varieties will be carried out in lab.

11. Expected Output from the Next Year Planned Research Work: Outcome may include rust pathogen virulence findings and characterization of resistance in elite and candidate wheat germplasm to foster new varieties at national level. Information on post-release resistance status of commercial cultivars will be obtained. Risks of wheat Seedborne diseases will be determined.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1.	DAP	01 Bag	4000
2.	Urea	02 Bags	4400
3.	Fungicide (Tilit)	500 ml	500
4.	Fungicide (Mancozeb)	500 gm	500
5.	Fumigation Tablets	01 Cane	500
6.	Glycine Selfing Bags	5000 Nos	15000
7.	Tags	3000 Nos	3000
8.	Rings for Tags	02 Kgs	1400
9.	Cotton Dori for Tags	03 Kgs	2100
10.	Plastic Rolls	15 Rolls	900
11.	Plastic Bags	10 Kg	3000
12.	Cloth Bags	200 Nos.	20000
		Grand Total	55300/-

Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
1	DAP	01 Bag	13000
2	Urea	01 Bags	2500
		Grand Total	15500

Project #: 02

1. **Project Title:** IPM of fruit worm, *Helicoverpa armigera* (Hub.) through egg parasitoid, *Trichogramma chilonis* (Ishii.) with Sterile Insect Technique (SIT) in tomato.
2. **Funding Source Type:** PAEC & IAEA.
3. **Principal Investigator:** Muhammad Zahid, PS/GL.
4. **Team members (Scientists & Staff):** Usman Khalique, JS; Noor Fatima, JS and Farhatullah, SA-III.
5. **Overall Project Objectives:** To protect tomato crop from fruit worm by developing and popularizing eco-friendly control tactics for safer and healthier crops.
6. **Specific Objective (If any):** Evaluation of parasitizing potential of *T. chilonis* with plant extract and SIT technique against tomato fruit worm in Lab. and high tunnel tomato.
7. **Background and Justification**: Fruit worm, *Helicoverpa armigera* is a serious insect pest of tomato crop and cause losses upto 32-35%. The present project is therefore of great importance which aims to develop Integrated Pest Management module for eco-friendly management of tomato fruit worm.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Minimum mean fruit worm infestation (0.27 larvae/ plant) was recorded significantly in treatment T1 (*Trichogramma* 3000 + *B*. *bassiana* @ $1x10^8$ spores /ml) as compared to check i.e., 1.11 larvae/plant. Tomato yield was found maximum in T1 (*Trichogramma* 3000 + *B. bassiana* $1x10^8$ spores/ ml) i.e., 6.07 kgs/48 ft^2 as compared to check i.e., 3.27 kgs/48 ft^2.
      ii. Maximum fruit worm moth population was recorded in April i.e., 9.0 moths /trap followed by March and May (6.0), June (3.0) in high tunnel tomato and maximum moth population was also found in April i.e., 15.0 moths /trap followed by March (12.0), May (9.0), June (6.0) & no moth was found from January to February in high tunnel tomato and chickpea field. Fruit worm moth population was higher in March-April in chickpea as compared to high tunnel tomato.
      iii. Chickpea flour base artificial diet was found very effective with minimum larval/ pupal period with low mortality rate, high adult emergence & fecundity rate.
   b. **Crop variety/ Patent/ Lab. Accreditation/ Product certification by authorized department:** N.A.
   c. **Ongoing/ Awarded funded Project (s) (PI/Co-PI): (July 2021-June 2022):**

Project title	PI & Co-PI	Funding agency/ Total budget/ starting & completion dates
Environment friendly management of fruit worm, *Helicoverpa armigera* (Hub.) through *Trichogramma* coupled with sterile insect technique (SIT) in tomato/ okra in greenhouse/field conditions.	Muhammad Zahid, PS/PI	IAEA/4.92 million Starting =17.3.2017 & Completion=16.3.2023.

d. Submitted Projects (July 2021- June 2022):

Project Title	PI & Co-PI	Funding agency/ total budget/ starting and completion dates	Status
Development of mass rearing facility for chickpea pod borer, *Helicoverpa armigera*& fall armyworm, *Spodoptera frugiperda* for Sterile Insect Technique (SIT) coupled with other IPM components.	Muhammad Zahid, PS/ PI	IAEA/8.1 M/NA	In-process
Feasibility researches for commercialization of Black Solider fly as sustainable proteinaceous food for Poultry industry in Pakistan.	Muhammad Zahid, PS/Co-PI	Pakistan Science Foundation 4.0 million	-do-

e. Published Research Paper:

i. Salman, M., M.H. Khan, **M. Zahid**, G.Z. Khan, F. Rahim, U. Khalique. 2022. Comparative ovipositional preference of the peach fruit fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) for selected fruits under free-choice laboratory setting. Sarhad Journal of Agriculture, 38(2): 572-577.

ii. Khalique, U., **M. Zahid**, N. Fatima, S.J.A. Shah. 2021. Evaluation of Pakistani Wheat against aphid, *Schizaphis graminum* (Rondani) under favourable weather conditions in Peshawar, Pakistan. Journal of Innovative Sciences, 7(2): 215-221.

iii. Khalique, U., **M. Zahid,** M. Salman, S.J.A. Shah. 2021. Insect pests of stored wheat and management. Zarat Nama, KPK, July issue: 19-20.

f. Conducted Event (As PI/Co-PI): NA

9. Training Attendant:

Title	Period	Place
Time management.	PPMI, Islamabad.	February 09-11, 2022.

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Evaluation of egg parasitoid, *T. chilonis* with plant extract against tomato fruit worm, *H. armigera* infestation in high tunnel tomato.

ii. Improvement of tomato fruit worm, *H. armigera* culture on natural/ artificial diets.

iii. To assess irradiation doses for male sterility of fruit worm, *H. armigera* and subsequent mating compatibility with wild females in Lab./ high tunnel tomato.

iv. Ecological study of tomato fruit worm, *H. armigera* through pheromone baited traps in high tunnel/ field conditions.

11. Expected Output from the Next Year Planned Research Work: Development of eco-friendly control technology for the management fruit worm.

12. Expenditure and Requirements:

Expenditure (2021-22)

S. #	Item	Quantity/ #	Approx. Expend. (Rs)
1.	DAP.	1.0 bag.	6550/-
2.	Urea.	1.0 bag.	2300/-

3.	Tomato nursery plants	250 nos.	2000/-
		Grand Total	16300/-

Requirements (2022-23)

S. #	Item	Quantity/ #	Approx. Expend. (Rs)
1.	DAP.	1.0 bag.	13000/-
2.	Urea.	1.0 bag.	2500/-
3.	Tomato nursery plants.	250 nos.	2500/-
		Grand Total	18000/-

Project #: 03

1. **Project Title:** Development of parthenium based biopesticide and low cost ovitraps against deadly mosquitoes- as alternative to insecticides.
2. **Funding Type:** PAEC
3. **Principal Investigator:** Dr. Gul Zamin Khan, PS
4. **Team Members (Scientist & staff (s):** Dr. Inamullah Khan, PS and M. Taufeequllah, General Attendant.
5. **Overall Project Objective (es):** Integrated vector mangemengent of dengue mosquitoes.
6. **Specific Objective (If any):** Mosquitoes Trapping, Formulation, Persistency & Safety test of the Bio-pesticide.
7. **Background and Justification (If new project):** Although chemical control is effective and being used under emergency outbreaks but due to its hazardous effect on health, environment and development of resistance in vectors, and increasing attention is now being focused on biopesticides. These are easily degradable and provide the cheapest control of mosquito control.
8. **Main findings of the Previous Year (2021-22) Research Work:**
   a. **Research findings:**
      i. Standardization of the effective formulation for the parthenium based bio-pesticide.
      ii. The black traps baited with fish meal for attraction are were found mainly effective for monitoring.
      iii. Various level of resistance was detected in different sites and can be utilized in revising management strategies.
   b. **Crop variety/ Patent/ Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/ Awarded funded Project (s) (PI/Co-PI): (July 2021-June 2022)**

Project title	PI & Co. PI	Funding agency/total budget/Starting & Completion Date
Enhancing the Capacity and the Utilization of the Sterile Insect Technique for Aedes Mosquito Control. (IAEA RAS 5095)	National Project Coordinator.	IAEA/Technical cooperation/March, 2022 to 2026

d. Submitted Projects as PI:

Project title	PI & Co. PI	Funding agency/ total budget/ Starting & Completion Date	Status
Exploiting Parthenium based bio-pesticides against the deadly Dengue vector Mosquitoes in Pakistan.	Dr. Gul Zamin Khan, P.S (P.I) Dr. Inamullah Khan, P.S (Co-P.I)	Under National Technology Innovation Fund (NTIF) by PSF/8M	Unknown
Management of Insects pests of Cotton with special emphasis on Pink Bollworm (PBW) through exploitation of SIT, augmentation & conservation of natural enemies and behavioral techniques.	Dr. Gul Zamin Khan, P.S (P.I)	PAEC/5M	-do-
Characterization and prioritization of behavioral & biological control methods for the Integrated Management of Codling Moth in Pome Fruits.	-do-	Collaboration with Chinese Academy of Agricultural Sciences, China. 12M	-do-
Submission of dashboard project entitled “Development of Parthenium based bio-pesticide against the deadly dengue vector mosquitoes”.	Dr. Gul Zamin Khan, P.S (P.I) Dr. Inamullah Khan, P.S (Co-P.I)	PAEC/8M	-do-
Concept paper for potential donors entitled “Integrating Sterile Insect Technique (SIT) with conventional tactics for the sustainable management of deadly dengue vectors”.	Dr. Gul Zamin Khan, P.S (P.I) Dr. Inamullah Khan, P.S (Co-P.I)	Collaboration with national / international donors". (Ministry of Planning, Development and Special initiatives, Health section). 25M	-do-

e. Published Research Paper:

- Naveed, H., K. Sohail, **G.Z. Khan** and Y. Zhang. 2021. Oriental leafhopper (Hemiptera: Cicadellidae: Parallygus) first report from North West Pakistan

with Redescription of Parallygus rameshi Viraktamath and Webb. Sarhad Journal of Agriculture, 37(3): 954-956.

- **Khan G.Z.,** S.J.A. Shah, H. Shah and M. Salman 2021. Integrated Management of insect pests and diseases of citrus and stone fruits in district Buner (Urdu Article). Zarat Nama, KPK, 44 (10):16-19.

f. Event organized (As PI/Co-PI):

Event Title	PI & Co-PI
Organized and successfully conducted 2 weeks, Postgraduate training course on the use of Nuclear and other Techniques in Food & Agricultural research as Convener (04-15, October, 2021).	Organizer

9. Training attendant:

Title	Period	Place
Successful completion of QMS Auditor Certification course, ISO 9001:2015 standard by DQM	August 04-06, 2021	NIFA
Office procedures and Management	28-30 June 2022	PARD, Peshawar.
Virtual Kick off Meeting of IAEA RAS 5095	20 April, 2022	Virtual

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023

i. Bio-safety trials of the formulated bio-pesticide to non-target organisms (Frogs, Fish) in the aquatic mosquitos' habitats.
ii. Persistency period of the Bio-Pesticides under natural habitats.
iii. Assessment of effective killing agents in the traps (Only pesticides will be tested, the IGRs will be studied by Dr. Inamullah Khan as in his planned research.
iv. Calculations of cost benefit ratio of biopesticides over commercials chemicals.

11. Expected Output from the Next Year Planned Research Work: To work out the efficient low-cost bio-pesticides and traps against the mosquitoes.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1	Traps Materials from scraps	500 No.	700
2	Pesticides various groups	500 ml/50g/ 20g/100ml	2500
3	Larval Diets (Yeast powder, bovine liver, various grains)	4 Kg	2000
4	NaHCo3	15 Kg	1500
5	Sticky Gums solution	2 Kg	500
6	Albino rats (Adult pair)	5 pair	2500.0
7	Tray cover	20 meter	5000.0
		Grand Total	14700/-

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1	Traps Materials	200 No.	2500

2	Insecticides and IGRs (Temophos, Deltamethrin, Pyreproxyfen)	500 ml	6000
3	Larval Diets (Yeast powder, bovine liver, various grains)	5 Kg	5000
4	Albino rats (Adult pair)	5 pairs	2500
5	NaHCO3	20 Kg	2000
6	Repair of Grinder	--	2000
		Grand Total	20,000

Project #: 04

1. **Project Title:** Enhancing the Capacity and the Utilization of the Sterile Insect Technique for Aedes Mosquito Control.
2. **Funding Type:** PAEC/IAEA Technical Cooperation.
3. **Principal Investigator:** Dr. Gul Zamin Khan, PS
4. **Team Members (Scientist & staff (s):** Dr. Inamullah Khan, PS and M. Taufeequllah, General Attendant.
5. **Overall Project Objective (es):** Developement of SIT as long-term sustainable strategies against dengue vectors.
6. **Specific Objective (If any):** Upscaling of mosquitoes rearing, sterility of mosquito as pre-requisite for SIT.
7. **Background and Justification (If new project):** Due to an increasing trend in insecticide resistance in mosquito vectors, and the residue effect of chemical insecticides in the environment, there is an urgent need for alternative and effective approaches to vector control in Asian countries. The current project under IAEA umbrella will be utilized for capacity building (vector surveillance, upscaling of rearing, field cage tests and mosquito's biology etc.) following a phased conditional approach (PCA) set by IAEA.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** New Project.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/ Awarded funded Project (s) (PI/Co-PI): (July 2021-June 2022)**

Project title	PI & Co-PI	Funding agency/total budget/Starting & Completion Date
Enhancing the Capacity and the Utilization of the Sterile Insect Technique for Aedes Mosquito Control. (IAEA RAS 5095)	National Project Coordinator.	IAEA/Technical cooperation/March, 2022 to 2026

   d. **Submitted funded Projects: (July 2021-June 2022):**
   Provided under project # 3.
   Published Research Paper: Provided under project # 3.
   e. **Event organized (As PI/Co-PI):** Provided under project # 3.
9. **Training attendant:** Provided under project # 3.
10. **Summary of the Planned Research Work for the Year July, 2022 - June, 2023**
    i. Utilization of mass production cages for up scaling of rearing of Aedes Mosquitoes.
    ii. Surveillance of prevailing mosquitos' species.
    iii. Assessment of biological quality of dengue vector wild strains & sterile males.

11. Expected Output from the Next Year Planned Research Work:

i. Upscaling of Aedes mosquitoes.
ii. Transition to the next phase.

12. Expenditure and Requirements:

Expenditure (2021-22): New Project.

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1	Traps Materials	500 No.	8000
2	Larval Diets (Yeast powder, bovine liver, various grains)	5 Kg	5000
3	Albino rats (Adult pair)/Bovine blood	5 pairs	3000
4	Materials for Fabrication of cages		60000
		Grand Total	76000

Project #: 05

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:** PAEC & IAEA Research Contract (IAEA RC-24975)
3. **Principal Investigator:** Dr. Inamullah Khan PS.
4. **Team members (scientists & staff):** Dr. M. Hamayoon Khan SS, Mr. M. Salman SS, Mr. Fazal Rahim, PSA and Taufeequllah General Attendant.
5. **Overall Project Objectives):**
   a) Use of gamma irradiation as phytosanitary treatment for the control of cotton mealy bug *Phenacoccus solenopsis*, pod borer *Helicoverpa armigera*, *Heliothis zea* and grain mite *Acarussiro*.
   b) Effect of factors and modified atmosphere, dose rate, and packing on phytosanitary irradiation.
6. **Specific Objective (If any):** Determine specific doses for the control of *Phenacoccus solenopsis*, *Helicoverpa armigera*, *Heliothis zea* and *Acarussiro*.
7. **Background and Justification (If new project) :** World trade of agriculture commodities continue to grow. This will also result in the introduction and establishment of exotic pests into new areas where the pests are absent. This invasion of exotic pest's establishment has resulted in un-controllable increase in the damage/ losses to agriculture products. Accordingly, the world trade organization (WTO) has adopted strict quarantine restrictions on trade of agriculture commodities to overcome these emerging threats of exotic species. The Phytosanitary irradiation (PI) treatment of food commodity is WTO acceptable because it is environment friendly, cause uniform penetration into the commodity, does not have any residues or health risks but helpful in killing and inactivating the contaminating microorganisms, food borne pathogens and insect pests.
8. **Main findings from the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:** Project just initiated.
   b. **Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil

c. Ongoing / awarded funded Project (s) (PI/Co-PI) (July 2021- June 2022):

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
Investigating the effect of gamma irradiation in the production of pest free commodities for trade promotion in Pakistan and elsewhere	As PI	IAEA RC-24975. Euros= 40000.0 2022 to 2026.
Hunt for naturally existing tsl mutation in *Aedes* aegypti and *Ae. albopictus* for construction of more robust Genetic Sex Strain (GSS) for SIT	As Co-PI	IAEA CRP-24085/R0. Allocated budget Euro= 24000.0. (2020-2026).

d. Submitted funded project: (July 2021-June 2022)

Project Title	PI & Co-PI	Funding Agency/ total budget	Status
Improvement, production and commercialization of Dengue Guard repellent for protection against mosquito and other biting insects.	PI	PSF PSF-National Tech. Innovation Fund Rs= 19.5 M	Not known
Proposal for inter-sectorial dengue abatement program of Khyber Pakhtoonkhwa (KPK) Health department and NIFA.	PI	KPK Health Department Rs= 16.1 M	Sent to Secretary by PAEC but status is not known
Evaluation of attractive lethal ovitraps of Insect Growth Regulators (IGRs) for attract and kill strategy in mosquito control and their surveillance.	PI	WHO/ TDR Implementation Research (US$ 10000.0	(not processed by PAEC HQ) for being late from 3-4 weeks gape.
Collaboration in Agri.& Biotech matters with China.	PI	Pak-China (Concept paper)	Not known
"Integrating Sterile Insect Technique (SIT) with conventional tactics for the sustainable management of deadly dengue vectors".	Co-PI	Ministry of Planning, Development and Special initiatives, Health section). 25M	Not known

e. Published Research Paper:

Khan I., M. Zahid. The role of gamma irradiation in the Phytosanitary Treatments & Control of Insect Pests of Quarantine Importance. Abs. Climate Smart Agriculture Innovations & Adaptations, Faculty of Agriculture University of Pounch Rawalakot June. 15- 17, 2022.

f. Event Organized (As PI/Co-PI):

Event title	**PI or Co-PI**
Weekly Seminars	As Convener

9. Training Attended: Nil

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023

a. Establishment of phytosanitary laboratory at NIFA
b. Collection, identification and establishment of the cotton mealy bug colony in the NIFA phytosanitary laboratory.
c. Collection, identification and establishment of the pod borer colony at NIFA phytosanitary laboratory.
d. Study on the biology of pests colonized in the Phytosanitary laboratory
e. Investigating the effect of gamma irradiation as phytosanitary treatment for the control of cotton mealy bug *Phenacoccus solenopsis*.
f. See the effect of dose rate on phytosanitary irradiation of targeted pests.

11. Expected Output from the Next Year Planned Research Work:

Laboratory will be set up for further work on pest species. Procedure for host rearing on artificial and natural host of pod borers will be developed.

12. Expenditure and Requirements: (Provision of requirements will depend on availability of funds)

a. Expenditure: New Project

b. Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure (Rs)
1	Diet ingredients	Various quantities	100000.0
2	Laboratory set up	-	400000.0
3	Filter papers	5 boxes	3000.0
4	Glass wear	Various items and their quantities	20000.0
5	Plastic bottles and bins	60 bottles, 4 bins	10000.0
6	Sample collection POL/TA/DA		100000.0
7	field for chickpea cultivation	1-2 Kanal plot at NIFA	5000.0
		Grand Total	638000.0

Project #: 06

1. **Project Title:** Integration of conventional and novel techniques for the development of environment friendly management strategies against mosquito vectors.
2. **Funding Type:** PAEC
3. **Principal Investigator:** Dr. Inamullah Khan, PS.
4. **Team members (Scientists & staff):**Dr. Gul Zamin, Mr. Taufequllah General Attendant.
5. **Overall Project Objectives:**
   i. Evaluation of Insect growth regulators (IGRs) in ovitraps as alternative to pesticides.
   ii. Enhancing mosquito rearing with the use of proper larval and adult diets.
6. **Specific Objective (If any):** Evaluation of various adult diets on male female's biological parameters (development, fecundity and fitness).
7. **Background and Justification (If new project):** NA
8. **Main findings of the previous year (2021-22) work:** (Brief findings)
   a. Research findings:
      i. **IGRS on mosquito development.**
         - Highest eggs hatching inhibition (80%) occurred in pyriproxyfen followed by novaluron (66%) and lowest by larvicol (39%).

- Both pyriproxyfen and novaluron resulted in highest Larval mortality (98-100% followed by larvicol (39%).
- Larvae could reach pupal stage in Pyriprofyfen and novaluron.
- Though Larvicol resulted in lowest eggs hatch & larval inhibition but additionally, there was 24% pupal inhibition.

ii. **IGRS in adult Diet:**

- Less number of eggs were laid by females fed with 1ppm of IGRs as compared to control.
- Eggs hatchability was also reduced from 64% in control to 13% by pyriproxyfen, 40% by novelron and larvicol.
- On average 20 to 51% eggs hatching inhibition was recorded from various IGRs as compared with control.
- Survival of both male and females was badly affected due to IGRs. There was 20-22 days reduction in the survival of both male and females

iii. **IGRS in Ovitraps:**

- No repellency was recorded from IGRs in attractive ovitraps
- More eggs were recorded from outdoor ovitraps as compared to indoor ovitraps.
- Less Eggs hatching occurred in Pyriproxyfen (38% indoor, 36 % outdoor) followed by Novelron (56% indoor, 40 % outdoor) as compared to 89% in control.
- Hatching inhibition due to IGRs was the same both in indoor and outdoor ovitraps.
- None of the IGR treated traps resulted in adult emergence.
- Adult emergence was only recorded from control traps.

b. Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department:
Trade Mark for NIFA Dengue Guard was registered with Intellectual Property Rights (IPO), Ministry of Science and Technology, Government of Pakistan.

c. Ongoing/awarded funded Project (s) (PI/Co-PI): (July 2021-June 2022): Mentioned under Project above

d. Submitted funded project: (July 2021-June 2022): Mentioned under Project above

e. Publish Research papers: Mentioned under Project above

f. Event Organized (As PI/Co-PI): Mentioned under above

9. Training Attended: Ni**l**

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023

i. Various adult diets from natural sources such as honey, fruit and herbal extracts, will be compared with sugar solution for evaluation on male female's biological parameters (development, fecundity and fitness).

ii. Evaluation of Insect growth regulators (IGRs) in ovitraps as alternative to pesticides. (The pesticide part as killing agent in ovitraps will be studied by Dr. Gul Zamin Khan as in his planed research.

iii. Filing for Dengue Guard patent will be initiated and public private partnership with industries and related R&D in the improvement of product quality will be done as per demand of industry.

11. Expected Output from the Next Year Planned Research Work:

- Adult diets will be developed for efficient rearing of mosquitoes
- Procedures for NIFA Dengue guard commercialized will be finalized.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure (Rs)
1	Diet ingredients	6 Kg	-
2	Filter papers	5 boxes	-
3	Insecticide/ IGRs	0.25 Kg	-
4	Albino Rats	5 pairs	2500.0
5	Plastic Pepsi bottles for ovitraps	60 bottles	-
		Grand Total	2500.0

Requirements (2022-23)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
1	Diet ingredients	3 Kg	3000.0
2	Filter papers	12 boxes	5000.0
3	Sugar	5 Kg	600.0
4	Albino Rats	5 pairs	2500.0
5	Cloth for tray covers	10 meter	5000.0
6	Plastic bins for ovitraps	60.no	5000.0
7	Rubber bands/ plastic bags	10 packs	500.0
		Grand Total	21600.0

Project #: 07

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/GL.
4. **Team Member (Scientist & Staff**): Mr. Muhammad Irfan, JS, Mr. Midrarullah (SSA)
5. **Overall Project Objectives:**
   - Development of organic anti-termite product to replace the synthetic termiticides for ecofriendly management of termites.
6. **Specific Objectives (If any)** NA
7. **Background and Justification:** The control of subterranean termites is very difficult because of their cryptic nature. Conventional use of repellent insecticide beneath the structures is considered to be major resort for control of termites for last many decades, but it's very expensive and environmental hazardous method. Therefore there is need to integrate eco-friendly management techniques for termite control such as use of biological control and organic compound. Therefore the following research plan will be helpful in finding alternatives termite management through plant extracts which are also organic and eco-friendly.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Clove found very effective against termites even at lowest aqueous solution of 0.125% but for quick knock down of termites dose of 1% clove and higher is recommended.
      ii. Garlic is not effective when used in concentration less than 5%.
      iii. Clove when mixed with garlic in ratios 1:4 (Clove: Garlic) or less found effective regarding toxicity and deterrence against termites.
      iv. Garlic had antagonistic impact on mortality when mixed with clove in ratios higher than 1:5 (1Clove: 5Garlic).

v. Clove remains highly deterrent longer than garlic against termites even at lower concentrations.

b. Crop variety/ Patent/ Lab. Accreditation/ Product certification by authorized department: N.A.

c. Ongoing/awarded funded Project (s) (PI/ Co-PI): (July 2021–June 2022) Nil

d. Submitted funded project: (July 2021 – June 2022): Nil

e. Published Research Paper:

- Irfan. M, M. Misbah-ul-Haq Kamad/ganna per deemak ka hamla aor us ka tadarak. Zaraat naama. Registered No P-217, PP 15-17, volume 45 (4), 2021.

f. Event Organized (As PI/Co-PI): Nil

9. Training attended:

Title	Period	Place
QMS auditor certification course based on ISO 9001-2015 standards by DQM	04 - 06 August, 2021	NIFA, Peshawar

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Alcohol based extracts of clove (0.25%, 0.50% & 1%) and garlic (5%) will be tested against subterranean termites for their toxicity and deterrence against subterranean termites.

ii. Stock solution of clove extract (aqueous) will be prepared by adding suitable inert materials to formulate the marketable anti-termite organic product.

iii. Shelf life of stock solution will be determined by performing periodic toxicity and deterrence tests in lab against termites.

iv. Comparative efficacy trials will be performed between available synthetic termiticides in market and anti-termite organic product prepared by us in Termite lab.

11. Expected Output from the Next Year Planned Research Work:

- An organic anti-termite liquid formulation of clove and garlic for eco-friendly management of termites.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Lab supplies (Glass wares, grinder, foil sheet, polygon tubes, plastic wares etc.)	-	50,000/-
2.	Insecticides, botanicals, organic solvents etc.	-	50,000/-
		Grand Total	100,000/-

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	(Glass wares, grinder, foil sheet, polygon tubes, plastic wares etc.)	-	75,000/-
2.	Synthetic termiticide, botanicals, organic solvents etc.	-	75,000/-
		Grand Total	150,000/-

Project #: 08

1. **Project Title:** Hunt for naturally existing tsl mutation in *Aedes aegypti and Ae. albopictus* for construction of more robust Genetic Sexing Strain (GSS) for SIT.
2. **Funding Source Type:** IAEA
3. **Principal Investigator:** Dr. Muhammad Misbah ul Haq, PS/GL.
4. **Team Member (Scientist & Staff):** Mr. Muhammad Irfan, JS.
5. **Overall Project Objectives:** (1-2 lines)
   - Collection and up-scaling of *Ae. aegypti* and *Ae. albopictus* from different topographic areas of Pakistan in the mosquito lab of NIFA
   - Temperature sensitive lethal (tsl) mutation screening of wild populations of dengue vectors for existence of naturally existing tsl mutation to develop a GSS for efficient sex separation at mass scale needed for SIT.
6. **Specific Objectives (if any):**
   a) Establishment and up-scaling of Aedes mosquito colonies from different areas of Pakistan for tsl mutation screening.
   b) Identification of potential heat resistant and sensitive colonies of Aedes aegypti and Ae. albopictus.
7. **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.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Dengue vector mosquito species were collected from seven different topographic and climatic locations of Pakistan.
      ii. Four colonies of Aedes aegypti and one colon of Ae. Albopictus was up-scaled and screened for detection of tsl mutation.
      iii. Initial tsl screening revealed that *Ae. Albopictus* is more sensitive to heat than *Ae. aegypti* specie.
      iv. It was observed that variable sensitivity exist among strains of *Ae. Aegypti* collected from different areas when exposed to heat.
      v. Temperature of 40°C and 41°C for the time interval of 5 and 3 hours respectively was determined for future tsl mutation screening of dengue vector.
   b. **Crop variety/ Patent/ Lab. Accreditation/ Product certification by authorized department:** N.A.
   c. **Ongoing/awarded funded Project (s) (PI/ Co-PI): (July 2021 – June 2022)**

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates
IAEA CRP project 44003, Research Contract 24085 (2020 – 2024) “Hunt for naturally existing tsl mutation in *Aedes*	PI: Dr. M. Muhammad Misbah ul Haq	IAEA/24000€/ 2020-2025

aegypti and *Ae. albopictus* for construction of more robust Genetic SexStrain (GSS) for SIT.		

d. Submitted funded project (July 2021 – June 2022): Nil

e. Published Research Paper:

Misbah-ul-Haq, M.; Carvalho, D.O.; Duran De La Fuente, L.; Augustinos, A.A.; Bourtzis, K. (2022). Genetic Stability and Fitness of Aedes aegypti Red-Eye Genetic Sexing Strains with Pakistani Genomic Background for Sterile Insect Technique Applications. Front. Bioeng. Biotechnol., 10, doi:10.3389/fbioe.2022.871703. (IF 5.8)

f. Event organized (As PI/Co-PI): Nil

9. Training attendant: Nil

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Dengue vector (*Aedes aegypti and ae. albopictus*) will be collected from other climatic and topographic areas by installing ovi and larval traps.

ii. Collected colonies will be up-scaled separately in the mosquito lab for producing enough number of L1 larvae.

iii. Temperature sensitive lethal mutation (tsl) screening of up-scaled colonies will be done at 40 and 41^{o}C temperature for 5 and 3hrs respectively in water bath.

iv. Heat resistant conies will be developed by multiple exposure of colonies towards same temperature and time interval.

v. Iso-male colonies will be developed for potential resistant and sensitive dengue vector colonies.

11. Expected Output from the Next Year Planned Research Work: (2-4 lines)

Identification of heat sensitive and resistant dengue vector strains (wild populations) for construction of tsl based genetic sexing strain (GSS).

12. Expenditure and Requirements: Will be met from IAEA CRP 24085

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Air conditioner	1	120,000
2.	Lab equipment	-	300,000
3.	Lab Supplies and up-gradation	-	200,000
4.	Salaried, POL, Institute share, other etc.		380,000
		Grand Total	10,00,000/-

Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Uninterrupted Power supply system for standard lab conditions	One	300,000
2.	Lab equipment and Up-gradation of lab		200,000
3.	Lab supplies		100,000
4.	Salaried, POL, Institute share, other etc.		400,000
		Grand Total	10,00,000/-

Project #: 09

1. **Project Title:** Integrated Management of Fruit flies
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Dr. Muhammad Hamayoon Khan
4. **Team members (Scientist & staff):** Mr. Muhammad Salman SS & Mr. Fazle Rahim PSA
5. **Overall Project Objectives:** To facilitate production of residue and fruit fly free good quality fruits and vegetables.
6. **Specific Objective (If any):** Development and application of eco-friendly control strategies for sustainable management of fruit flies in horticultural crops.
7. **Background and Justification:** In Pakistan, three fruit fly species viz. *Bactrocera zonata*, *B. dorsalis* and *B. cucurbitae* 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.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)
   a. **Research findings:**
      i. Yeast Instant (YI) and sugar molasses (SM) attracted significantly higher population of *B. zonata* and *B. dorsalis* and hence the highest cumulative population of both species followed by treatment of protein hydrolyzate (PH).
      ii. Addition of ammonium acetate (AA) significantly enhanced the attractiveness of different food baits towards *B.* zonata and *B. dorsalis*.
      iii. In terms of percentage increase in attraction over simple food baits, blend of AA with PH and YI showed promising results thereby increasing the attraction of these baits for *B. zonata* and *B. dorsalis*.
      iv. Neem oil 2% and neem seed extract 4% were found to be the most promising repellents and oviposition deterrents against and hence, could be considered in the management plans.
      v. In Tarnab area fruit flies, *Bactrocera* species remained more active during 6:00 to 10:00 hours in the morning and 16:00-18:00 hours in the evening whereas in Malakandher area, maximum numbers of flies were captured between 5:30-9:30 hours in morning and 15:30-19:30 hours in evening.
   b. **Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department:** (Plant breeders working in one group cannot be considered as the breeders for variety approved by other group in this proforma e.g. wheat Rainfed breeders will only be considered breeders for Rainfed varieties and irrigated group breeders for irrigated varieties. Under process crop variety/lab accreditation/product certification by relevant authorized department in the country will not be acceptable) **N/A**
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI): (July 2021 –June 2022)**

Project title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates
"Investigating the effect of gamma irradiation in the production of pest free commodities for trade	Dr. Inamullah Khan & Dr. M. Hamayoon Khan	IAEA CRP/40K Euro/2022-2028

promotion in Pakistan and elsewhere		

d. Submitted funded project: (July 2021-June2022)

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates	Status
Improvement of honeybee keeping and its integration into the agro-forestry system of Khyber Pakhtunkhwa	Dr. M. Hamayoon Khan	Dashboard (SPD)/ 5.5 millions/ 5 years	In-process
Use of nuclear techniques for improved production and utilization of natural enemies in integrated management of sugarcane insect pests	Dr. M. Hamayoon Khan	IAEA TC/ - /5 years	In-process
3. Quality production of Bactrocera zonata and B. dorsalis for harmonized application of SIT with related technologies	Dr. M. Hamayoon Khan & Mr. Muhammad Salman	IAEA CRP/30K Euro/ 5 years	Regretted

e. Published Research Paper: (Papers published with student will not be considered from July, 2021-June, 2022. Papers published from own core/funded project up to 3 authors will be considered during this period). Published Urdu/English articles in Zarat Nama/Newspapers/Radio talks.

- Salman, M., **M.H. Khan,** M. Zahid, G.Z. Khan, F. Rahim and U. Khalique. 2022. Comparative Ovipositional Preference of the Peach Fruit Fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) for Selected Fruits under Free-Choice Laboratory Setting. Sarhad J. Agric. 38(2): 572-577.
- **Khan, M.H.,** Salman, M and S.J.A. Shah. 2021. Integrated pest management of white fly (Urdu Article). Zarat Nama, KPK, 45 (4):29-30.

f. Event organized (As PI/Co-PI): Nil

9. Training attended:

Title	Period	Place
Role of Nitric Oxide in the biology of eco-friendly insects and nematodes	30th November, 2021	AWKUM, Mardan
Application of GIS & Remote sensing in Agriculture"	May 24 -26, 2022	PARD, Peshawar
Honeybee Queen Health Perspective and Colony Productivity	22nd Jun, 2022	ARI, Tarnab Peshawar
Khyber Pakhtunkhwa Convention on Natural Resources and Taskforces Launch	14th March, 2022	PC, Peshawar

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Assessment of the attractiveness of selected food baits in combination with each other and certain chemicals in different ratios towards the fruit fly, *Bactrocera* species in hunt for developing a strong fruit fly attractant.

ii. Investigations on the diversity and incidence of different fruit fly species in various fruits and vegetables.

11. Expected Output from the Next Year Planned Research Work: The most effective combinations of food attractants and chemicals (2-3) for the attraction of fruit fly will be determined, which will further be refined and improved with the aim to develop an effective fruit fly attractant. Diversity and incidence of fruit fly species in various horticultural crops will be identified.

12. Expenditure & Requirements: (Provision of requirements will depend on availability of funds)

Expenditure (2021-22) Nil (Chemicals already available in lab. were used, some other materials required were managed from own pocket)

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
01	Tri-methylamine	1 liter	15,000/-
02	Putrescine	1 liter	-
03	Agar	0.5 Kg	12,000/
04	Plastic traps	500 No.	25,000/-
05	Ammonium acetate	01 Kg	3000/-
		Grand Total	55,000/-

Project #: 10

1. **Project Title:** Establishment of artificial rearing system for fruit fly in the context of Integrated Pest Management
2. **Funding Type:** PAEC
3. **Principal Investigator:** Muhammad Salman
4. **Team members (Scientist & staff):** Dr. Muhammad Hamayoon Khan SS & Mr. Fazle Rahim PSA
5. **Overall Project Objectives:** (1-2 lines). To facilitate fruit fly rearing and handling for improved fruit fly management.
6. **Specific Objective (If any):** (1-2 lines) To develop effective artificial adult diet for laboratory rearing of fruit flies.
7. **Background and Justification:** (3-5 lines)

Some preliminary work has been done in our latest experiments which provided the ground to develop some basic elements for the artificial rearing of *Bactrocera zonata* and *Bactrocera dorsalis* regarding ovipositional device, ovipositional stimulant and semisolid artificial larval diet comprising banana and yeast as main ingredients. Efforts are therefore, needed to work out artificial adult diet as well so that a complete laboratory rearing protocol may be established.

8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings)

a. Research findings:

- Identified the most suitable and effective ovipositional device for efficient rearing of *Bactrocera zonata* and *Bactrocera dorsalis* on artificial diet.
- Identified the most suitable ovipositional stimulant for efficient egg collection of *Bactrocera zonata* and *Bactrocera dorsalis* (guava juice).

- Developed the most efficient artificial larval diet comprising banana fruit and yeast as main ingredients for successful laboratory rearing of *Bactrocera zonata* and *Bactrocera dorsalis*.

b. Crop/Variety/Patent/Lab Accreditation/Product certification by authorized department: (Plant breeders working in one group cannot be considered as the breeders for variety approved by other group in this proforma e.g. wheat Rainfed breeders will only be considered breeders for Rainfed varieties and irrigated group breeders for irrigated varieties. Under process crop variety/lab accreditation/product certification by relevant authorized department in the country will not be acceptable) **N/A**

c. Ongoing/awarded funded Project(s) (PI/Co-PI): (July 2021–June 2022): Nil

d. Submitted funded project: (July 2021-June2022):

Project title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
Identification of cryptic species with population prediction of devastating fruit flies (Diptera: Tephritidae) through the application of molecular diagnostics, GIS, and artificial intelligence	Dr. Muhammad Sayyar, Associate Professor, IBGE, UAP, PI and Muhammad Salman, SS, Co-PI	LCF/ HEC/ 22.94 millions/ 3 years	Regretted
Quality production of *Bactrocera zonata* and *B. dorsalis* for harmonized application of SIT with related technologies	Dr. Muhammad Hamayoon Khan, SS, PI and Muhammad Salman, SS, Co-PI	IAEA CRP/30K Euro/ 5 years	Regretted

e. Published Research Paper: (Papers published with student will not be considered from July, 2021-June, 2022. Papers published from own core/funded project up to 3 authors will be considered during this period). Published Urdu/English articles in Zarat Nama/Newspapers/Radio talks.

- **Salman, M.,** M.H. Khan, M. Zahid, G.Z. Khan, F. Rahim and U. Khalique. 2022. Comparative Ovipositional Preference of the Peach Fruit Fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) for Selected Fruits under Free-Choice Laboratory Setting. Sarhad J. Agric. 38(2): 572-577.
- Khan, M.H., **Salman, M** and S.J.A. Shah. 2021. Integrated pest management of white fly (Urdu Article). Zarat Nama, KPK, 45 (4): 29-30.

f. Event organized (As PI/Co-PI): NIL

9. Training attended:

Title	Period	Place
IAEA TC (Virtual) Workshop on Challenges and Solutions in the	January, 12 – 19, 2022	PAEC HQ, Islamabad

Implementation of SIT Based Technologies Against Aedes Vectors		
Honeybee Queen Health Perspective and Colony Productivity	June, 22, 2022	ARI, Tarnab Peshawar
Climate Change & Food Security in Pakistan	July, 19 - 22, 2022	PARD, Peshawar

10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    - Maintenance of laboratory culture of three species of fruit flies viz. *Bactrocera zonata, B. cucurbitae* and *B. dorsalis.*
    - Assessment of various artificial adult diets for economized rearing of fruit flies.
    - Assessment of various fruits (mango, peach, guava and banana) for their pest harboring potential against *B. zonata* and *B. dorsalis*.
11. **Expected Output from the Next Year Planned Research Work:** Most suitable and efficient adult diet will be identified and economized fruit fly rearing will be established, in order to produce high quality insects for various experiments on biological control, botanical pesticides and other novel control tactics.
12. **Expenditure & Requirements:** (Provision of requirements will depend on availability of funds)

    Expenditure (2021-22) NIL (Chemicals already available in lab. were used some other materials required were managed from own pocket)

    Requirements (2022-23)

    (Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Apro. Expend. (Rs)
01	Casein	1 Kg	5,000/-
02	Protein Hydrolysate	2 Kg	3,000/-
03	Yeast	1 Kg	12,00/
04	Cotton	5 Packs	15,00/-
05	Camel hair brushes	12 No.	300/-
06	Dettol	10 bottles	1500/-
		Grand Total	12,500/-

Project #: 11

1. **Project Title:** Development of local attractive bait matrix and toxin delivery foraging stations for control of subterranean termites' species
2. **Funding Type:** PAEC
3. **Principal Investigator:** Muhammad Irfan, JS.
4. **Team members (Scientists & Staff):** Dr. Muhammad Misbah ul Haq, PS/ GL, Mr. Midrarullah, SSA.
5. **Overall Project Objectives:**
   Development of bait technology for the successful management of subterranean termites.
6. **Specific Objectives:** Efficacy Enhancement of developed bait matrix for lab. trials and Field efficacy trials of termite baits matrix for termite attraction.
7. **Background and Justification (If new project):** Subterranean termites are notorious pest of the agricultural crops and buildings structure in Pakistan. Usually frequent application of synthetic insecticides are used to manage the termites, which have many adverse effects including environmental hazardous. The use of bait technology is in rise for termite management globally since couple of decades Termites bait is sustainable, ecofriendly and easily usable termite management

strategy. The following research is plan to develop termite bait technology and its field trails.

8. Main findings of the Previous Year (2020-21) Work: (Brief findings)

a. Research findings:

i. Five different phagostimulants (glucose, fructose, sucrose, urea and yeast) were used for evolution of termite attraction. Blatting paper treated with sucrose @ 3% and yeast @ 2% were found with 60 % and 65% attraction of termites as compared to control 40% and 35 % ($p \leq 0.05$).

ii. Solid bait matrix developed with attractive cellulosic materials, nutrients and phagostimulants was found more palatable with 35% consumption as compared to poplar wood with 19% consumption ($p \leq 0.05$).

iii. Three different toxin were tested for their non-repellents and slow action toxicity. Pyriproxyfen showed very quick mortality while Coragen found with less mortality event at higher concentrations and termites have showed deterrence response from these both toxins. Lufenuron screened out as slow acting toxicant with LC_{90}, 220 ppm and LT_{90}, of 9 days and found with almost no repellent response. So Lufenuron have potential to be mixed in bait matrix as toxicant for sustainable management of subterranean termites

b. Crop variety/Patent/ Lab Accreditation/Product certification by authorized department: NA

c. Ongoing/ Awarded funded Project (s) (PI/ Co-PI): Nil

d. Submitted Funded Project (July 2021-June 2022)

Project Title	PI and Co-PI	Funding agency/ Total Budget/ Stating& Completion dates	Status
Development of Local attractive Bait matrix and toxin delivery foraging stations for the control of Pakistani Subterranean termites	As PI	PSF/PKR=2 M/under process.	In-process

e. Published Research Paper:

Irfan, M., M. Misbah Ulhaq, 2021, Attack of Termite on sugarcane crop and its management Zarat Nama, KPK. (November, 2021): 15-17 (Urdu Article).

f. Event organized (As PI/Co-PI):

Event title	PI or Co-PI
36th Post Graduate training Course "The Use of Nuclear and Other Techniques in Food and Agricultural Research" (October 04-15, 2021)	Co-organizer

9. Training attendant:

Title	Period	Place
IAEA TC (Virtual) Workshop on "Challenges and Solutions in the Implementation of SIT Based Technologies Against Aedes Vectors"	January 12-19, 2022.	PAEC, HQ. Islamabad
Four days training "Essentials IT Skills for Government Officials"	June 14 to 17, 2022.	PARD Peshawar

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Efficacy enhancement of bait matrix by adding different ratios (10, 20, 40, and 80%) of processed cellulosic materials.

ii. Establishment of foraging points in field crops and buildings structures for application and monitoring of bait matrix.
iii. Fabrication of appropriate bait casing for application of baits matrix at active foraging points.
iv. Field efficacy trials of bait matrix in effective fabricated casing in field crops and buildings.

11. **Expected Output from the Next Year Planned Research Work:** An effective bait matrix with appropriate casing will be developed, and available for further field applications against subterranean termites.
12. **Expenditure and Requirements:**

Expenditure (2021-22):

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Diet ingredients and chemicals	-	15,000/-
		Grand Total	15,000/-

Requirements (2022-23)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Diet ingredients and chemicals.	-	50,000/-
2.	Fabrication of Baits station	200	50,000/-
		Grand Total	1,00,000/-

Project #: 12

1. **Project Title:** Thermal screening of *Aedes aegypti and Ae. albopictus* for identification of potential heat sensitive strains.
2. **Funding Source Type:** IAEA
3. **Principal Investigator:** Mr. Muhammad Irfan, JS
4. **Team Member (Scientist & Staff):**, Dr. M. Misbah ul Haq, PS/GL,
5. **Overall Project Objectives:**
   i. Establishment and up-scaling of Aedes mosquito colonies from different areas of Pakistan for tsl mutation screening.
   ii. Identification of potential heat resistant and sensitive colonies of *Aedes aegypti* and *Ae. albopictus*.
6. **Specific Objectives (if any):**
   i. Establishment and up-scaling of Iso-male Aedes mosquito colonies collected from different areas of Pakistan.
   ii. Identification of Iso-male heat resistant or sensitive strains.
7. **Background and Justification (If new project):** 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.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings): Nil
   a. **Research findings:** NA
   b. **Crop variety/Patent/ Lab Accreditation/Product certification by authorized department:** NA
   c. **Ongoing/awarded funded Project (s) (PI/ Co-PI): (July 2021-June 2022)** Nil

d. **Submitted funded project (July 2021 – June 2022):** Nil
e. **Published Research Paper:** Nil
f. **Event Organized (As PI/Co-PI):** Nil

9. **Training attendant:** Nil
10. **Summary of the Planned Research Work for the Year July, 2022-June, 2023:**
    i. Iso-male colonies (1 male : 5 females) will be developed for each strain collected from different locations of Pakistan
    ii. Iso-male colonies will be up-scaled and their L1 larvae will be exposed to 40-41^{o}C for 3-5 hrs. to identify potential heat resistant and sensitive dengue vector strains.
11. **Expected Output from the Next Year Planned Research Work:** Identification of heat resistant and sensitive strains for construction of tsl based genetic sexing strain (GSS).
12. **Expenditure and Requirements:** Will be met from IAEA CRP 24085

Expenditure (2021-22): Nil

Requirements (2022-23)

S. #	Item	Quantity/#	Expenditure. (Rs)
1.	Lab. Supplies	-	200,000
		Grand Total	200,000

Project #: 13

1. **Project Title:** Eco-friendly management of lepidopterous insect pest, *Helicoverpa armigera* (Hub.) in tomato crop.
2. **Funding Source Type:** PAEC & IAEA.
3. **Principal Investigator:** Usman Khalique, JS.
4. **Team member (Scientists& Staff):** Syed Jawad Ahmad Shah, DCS, Muhammad Zahid, PS, Noor Fatima, JS and Farhatullah, SA-III.
5. **Overall Project Objectives:(1-2 lines)**
   Development of bio-pesticide product alternative to synthetic insecticides for the eco-friendly management, *Helicoverpa armigera*.
6. **Specific Objective (If any): (1-2 lines)**
   i. Exploration, isolation and identification of naturally occurring entomopathogenic fungi in different field crops.
   ii. Screening of different entomopathogenic fungi against *H. armigera*.
7. **Background and Justification:** *Helicoverpa armigera* is a polyphagous pest infesting more than 100 host plants and responsible for 53% fruit losses in tomato crop. Indiscriminate use of pesticides against *H. armigera* contaminates fruits/ vegetables and causes serious issues like health problems, destruction of beneficial insects and threaten the sustainability of agricultural systems. The present project is therefore, of great importance, which aims to develop eco-friendly bio-pesticide product alternatives to synthetic insecticides because of their selectivity to host and friendly with the environment.
8. **Main findings of the Previous Year (2021-22)Work:** (Brief findings)
   a. **Research findings:**
      i. Chickpea flour base artificial diet was found very effective with minimum larval (12.7 ± 0.46 days) and pupal period (10.5 ± 0.41 days), low mortality rate (4 ± 0.20%), high adult emergence (83 ± 0.32%) and maximum fecundity (598.2 ± 9.91 eggs/ female) and fertility rate (90.4 ± 2.24% egg hatching) as compared to other diets.

ii. Significant maximum mean mortality of tomato fruit worm was recorded in petri dishes treated with *B. bassiana* @ $1x10^8$ spores/ ml i.e., 86.9% while minimum mortality (26.8%) was recorded in *M. anisopliae* @ $1x10^7$ spores/ ml under laboratory conditions.

iii. Probit analysis showed that the lethal concentration (LC_{50}) recorded for *B. bassiana* and *M. anisopliae* was 1.721×10^7 and 3.966×10^7 spores/ ml respectively while lethal time (LT_{50}) recorded for *B. bassiana* and *M. anisopliae* was 10.230 and 10.496 days respectively.

b. Crop variety/patent/lab. Accreditation/Product certification by authorized department: (Plant breeders working in one group cannot be considered as the breeders for variety approved by the other group in this proforma e.g., wheat Rainfed breeders will only be considered breeders for Rainfed varieties and irrigated group breeders for irrigated varieties. Under process crop variety/lab accreditation/product certification by relevant authorized department in the country will not be acceptable.): N.A.

c. Ongoing/awarded funded Project (s) (PI/Co-PI):(July 2021 - June 2022): Nil

d. Submitted funded project:(July 2021 - June 2022): Nil

e. Published Research Paper: (Papers published with student will not be considered from July, 2021-June, 2022. Papers published from own core/funded project upto 3 authors will be considered during this period). Published Urdu/ English articles in Zarat Nama/ Newspapers/ Radio talks: Nil

f. Event organized (As PI/Co-PI): Nil

9. Training attendant:

Title	Period	Place
i. QMS Requirements and Implementation based on ISO 9001:2015 Standard.	Aug 02-03, 2021	NIFA, Peshawar.
ii. The use of Nuclear and other Techniques in Food and Agricultural Research.	Oct 4-15, 2021	NIFA, Peshawar.
iii. Phytopathology: Current Scenario and Future Prospects.	Nov 21-23, 2021	UAF, Faisalabad.
iv. Project Cycle Management in Public Sector.	Feb 21-25, 2022	PARD, Peshawar.
v. Application of GIS and Remote Sensing in Agriculture Sector.	May 24-26, 2022	PARD, Peshawar.

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. Field visits for the collection of samples (soil, plant parts and insect dead bodies).

ii. Isolation and identification of Entomopathogenic fungi associated with collected samples.

iii. Screening of entomopathogenic fungi against tomato fruit worm, *H. armigera* in laboratory.

11. Expected Output from the Next Year Planned Research Work: Based on research findings, most effective Entomo-pathogenic fungi against borers will be selected and further promoted as a bio-pesticide product for commercial use.

12. Expenditure and Requirements:

Expenditure (2021-22)

S. #	Item	Quantity/ #	Expenditure (Rs)
1.	Artificial diet ingredients and chemicals		44,800/-
		Grand Total	44,800/-

Requirements (2022-23)

S. #	Item	Quantity/#	Approx. Expend. (Rs)
1.	Lab supplies (Glass wares, plastic tape, foil sheet, plastic bags etc.)	--	40,000/-
		Grand Total	40,000/-

Project #: 14

1. **Project Title:** Environment friendly management of wheat aphid through host plant resistance and biological control.
2. **Funding Source Type:** PAEC& IAEA.
3. **Principal Investigator:** Usman Khalique, JS.
4. **Team member (Scientists & Staff):** Syed Jawad Ahmad Shah, DCS, Muhammad Zahid, PS, Noor Fatima, JS and Farhatullah, SA-III.
5. **Overall Project Objectives:** Development of Integrated Pest Management module for wheat crop against aphids.
6. **Specific Objective (If any): (1-2 lines)**
   i. Screening of different wheat genotypes against aphid resistance.
   ii. Evaluation of different plant extracts against wheat aphid for their insecticidal efficacy.
7. **Background and Justification:** Wheat aphid is the major insect pests of wheat crop which cause direct (35-40%) and indirect (20-80%) damage in wheat crop at farm level. The present studies are therefore, of great importance, which aim to develop Integrated Pest Management module for eco-friendly management of wheat aphid.
8. **Main findings of the Previous Year (2021-22) Work:** (Brief findings):

a. Research findings:

i. Population dynamics study showed that significant maximum mean aphid population was recorded during mid-February (16.6 aphids/ tiller) to 1st week of march (30.5 aphids/ tiller) in wheat cropping season 2021-22.

ii. Out of 1169 wheat genotypes, 24 genotypes were found immune, 137 (resistant), 260 (moderately resistant), 251 (tolerant), 182 (moderately susceptible), 230 (susceptible) and 85 were found highly susceptible to wheat aphids.

b. Crop variety/ Patent/ Lab. Accreditation/ Product certification by authorized department: (Plant breeders working in one group cannot be considered as the breeders for variety approved by the other group in this proforma e.g., wheat Rainfed breeders will only be considered breeders for Rainfed varieties and irrigated group breeders for irrigated varieties. Under process crop variety/ lab accreditation/ product certification by relevant authorized department in the country will not be acceptable.): N.A.

c. Ongoing/awarded funded Project (s) (PI/Co-PI): Nil

d. Submitted funded project: (July 2021 - June 2022): Nil

e. Published Research Paper: (Papers published with student will not be considered from July, 2021-June, 2022. Papers published from own core/ funded project up to 3 authors will be considered during this period). Published Urdu/ English articles in Zarat Nama/ Newspapers/ Radio talks:

i. **Khalique, U.,** M. Zahid, N. Fatima, S.J.A. Shah. 2021. Evaluation of Pakistani Wheat against aphid, *Schizaphis graminum* (Rondani) under favourable weather conditions in Peshawar, Pakistan. Journal of Innovative Sciences, 7(2): 215-221.

ii. **Khalique, U.,** M. Zahid, M. Salman, S.J.A. Shah. 2021. Insect pests of stored wheat and management. Zarat Nama, KPK, July issue: 19-20.

f. Event organized (As PI/Co-PI): N.A.

9. Training attendant: Same as in previous project.

10. Summary of the Planned Research Work for the Year July, 2022-June, 2023:

i. To investigate the population dynamics of wheat aphid on 220 different wheat genotypes.

ii. Under national wheat improvement program, National Wheat Disease Screening Nursery (NWDSN) consisting of 500-600 will be tested for resistance against aphid infestation.

iii. A set of 70-80 candidate varieties will be tested for resistance against aphid infestation.

iv. Different plant extracts will be evaluated against wheat aphids under laboratory conditions.

11. Expected Output from the Next Year Planned Research Work: (2-4 lines)

i. Host plant resistance studies will provide baseline information to foster the development of resistant wheat varieties against aphid.

ii. Selection of best/potential plant extract based on research findings for biopesticide product development.

12. Expenditure and Requirements:
Expenditure (2021-22): Nil
Requirements (2022-23): Nil

Project #: 15

1. Project Title: Eco-friendly management of store grain/ field insect pests through plant base extracts and bio-control agents.

2. Funding Source Type: PAEC & IAEA Research Contract-21002.

3. Principal Investigator: Noor Fatima, JS.

4. Team Members: Muhammad Zahid, PS, Usman Khalique, JS and Farhatullah, SA-III.

5. Overall Project Objectives:

i. Development of plant base product for effective control of store grain and field insect pests.

ii. Healthy production of egg parasitoid, *T. chilonis* culture on host eggs of *S. cerealella* reared on different stored cereals.

6. Specific Objective (If any):

i. To screen-out different plant extracts against store grain pests i.e. *Sitotroga cerealella, Sitophilus granaries* and tomato fruit worm, *Helicoverpa* armigera.

ii. To screen-out different stored cereals on the biological parameters and host preference of *S. cerealella* and subsequent quality of *T. chilonis*.

7. Background and Justification (If new project): *Sitotroga cerealella* and *Sitophilus spp.* are major stored grain pests that cause huge damage to stored commodities. These pest feeds voraciously on a large great variety of grains such

as oats, wheat, rice, barley and corn. Highly infested grains become completely hollow inside and only the outer thin shell remains intact. It is estimated that almost 63.85% of grain weight losses occurred due to 3-6 months of storage by stored grain insect pests.

Trichogramma has a potential to parasitize borer's eggs upto 70-80% in the field but have shorter longevity and lower fecundity rate. Different biological parameters of *Trichogramma* culture is needed to improve on host eggs of *Sitotroga.* The present studies are therefore, of great importance which aims to screen the most suitable cereals for increasing the production of *Sitotroga* moths to obtain maximum host eggs for efficient parasitoid production.

The present project is therefore, of great importance which aim to screen and select the most suitable botanical extract against stored grain/ field insect pests and also improved the *Trichogramma* culture on different cereals.

8. Main findings of the Previous Year (2021-22) Work

a. Research findings:

i. Oat and maize proved to be the most preferred food and best alternatives to wheat for mass rearing of *Sitotroga* in Lab. condition.

ii. Wheat grains are most suitable rearing medium for *Sitotroga* eggs production for maximum parasitism & adult emergence of *Trichogramma* for mass scale rearing of *Trichogramma* in Lab. However for commercial production of *Trichogramma* cards, millet can be used as alternate of wheat crop to improve the efficiency of *Trichogramma.*

iii. Clove oil concentration @ 2.5% can be used as a toxic plant extract for the control of *Sitophilus granaries* for 21 days.

b. Crop variety /Patent/ Lab. Accreditation/Product certification by authorized department: (Plant breeders working in one group cannot be considered as the breeders for variety approved by the other group in this proforma e.g., wheat Rain fed breeders will only be considered breeders for Rain fed varieties & irrigated group breeders for irrigated varieties. Under process crop variety/lab accreditation/product certification by relevant authorized department in the country will not be acceptable.): N.A.

c. Ongoing/Awarded funded Project(s) (PI/Co-PI) (July 2021-June 2022): N.A

d. Submitted projects(July 2021- June 2022):

Project title	PI & Co-PI	Funding agency/total budget/ starting & completion dates	Status
1. Feasibility researches for commercialization of Black Solider fly as sustainable proteinaceous food for Poultry industry in Pakistan.	Noor Fatima (JS) & M. Zahid (PS)	Pakistan Science Foundation 4.0Million (In process).	In process

e. Published Research Paper: (Papers published with student will not be considered from July, 2021-June, 2022. Papers published from own core/funded project up to 3 authors will be considered during this period.) Published Urdu/English articles in Zarat Nama/ Newspapers / Radio talks:

Khalique, U., M. Zahid, **N. Fatima,** S.J.A. Shah. 2021. Evaluation of Pakistani Wheat against aphid, *Schizaphis graminum* (Rondani) under favourable

weather conditions in Peshawar, Pakistan. Journal of Innovative Sciences, 7(2): 215-221.

f. Event Organized (As PI/ Co-PI): N.A.

9. Training Attendant:

Title	Period	Place
1. QMS requirements & implementation based on ISO 9001:2015 Standard.	August 02-03, 2021	NIFA, Peshawar.
2. The use of Nuclear & other techniques in Food & Agricultural Research.	October 4-15, 2021	NIFA, Peshawar.
3. Training course on "Young officer's orientation course" (Part I).	December 06-17, 2021	DHRD, PAEC, Islamabad.
4. Training course on "Young officers orientation Course" (Part II).	March 06-18, 2022	PCENS Chakri, Islamabad
5. International conference on "Climate smart agriculture innovations & adaptations."	June 15- 17, 2022	University of Poonch, Rawalakot.

10. Summary of the Planned Research Work for Year July,2022-June, 2023:

i. Maintenance of *Sitotroga cerealella* culture in lab conditions.
ii. Screening of different plant extracts against store grain insect pests and tomato fruit worm, *Helicoverpa armigera* (Hub.) in vitro conditions.
iii. Assessment of parasitizing potential of *Trichogramma* under different storage conditions.
iv. Evaluation of different wheat varieties against store grain insect's i.e.; *Sitotroga cerealella* (Oliv.), wheat weevil, *Sitophilus granaries* in lab. condition.

11. Expected Output from the Next Year Planned Research Work:

i. Best botanical extract will be selected and further evaluated for product development.
ii. To ensure food safety & security through eco-friendly management of stored grain/ field insect pests.

12. Expenditure and Requirements:

Expenditure (2021-22):

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Lab. Assistant.	One	-
2.	Wheat seeds.	100 kgs.	4000/-
3.	Plastic jars, oval jars, glass jars etc.	100 nos.	6000/-
		Grand Total	10,000/-

Requirements (2022-23)

(Provision of requirements will depend on availability of funds)

S.#	Item	Quantity/#	Approx. Expend. (Rs)
1.	Lab. Assistant.	One	-
2.	Wheat seeds.	100 kgs.	7000/-
3.	Plastic jars, oval jars, glass jars etc.	100 nos.	6000/-
4.	Botanicals oils.	5.0 nos.	5000/.
		Grand Total	18,000/-

SOIL & ENVIRONMENTAL SCIENCES DIVISION

Project #: 01

1. **Project Title:** Biofortification of zinc (Zn) in wheat for balanced human nutrition
2. **Funding Source Type:** PAEC/ IAEA
3. **Principal Investigator:** Dr. Muhammad Imtiaz, DCS
4. **Team member (Scientists & Staff):** Mr. Parvez Khan, PS
   Mr. Ghaffar Ali, Research Associate
   Mr. Muhammad Adeel Khattak, SA-I
5. **Overall Project Objectives:** To alleviate the nutrients (Zn and Fe) malnutrition by exploiting the genetic diversity of wheat genotypes and efficient utilization of micronutrients in less fertile soils for high yield.
6. **Specific Objective:** To study differential growth response and Zn acquisition of wheat genotypes under Zn deficient conditions.
7. **Background and Justification:** Biofortification is the process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding or modern biotechnology. It is a feasible and cost-effective means of delivering micronutrients to populations that may have limited access to diverse diets and other micronutrient interventions. Research efforts have demonstrated that this agriculture-based method of addressing micronutrients deficiency through nutrient management works.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Wheat genotypes NRL-1929, Zincol and NRL-1812 produced the maximum biomass at Zn deficient level (2 pM) and are characterized as Zn-efficient
      ii. Wheat genotype NRL-1825 and NRL-1928 were ranked as Zn-inefficient because they produced the minimum quantity of biomass at 2 pM.
      iii. Zn efficiency of genotypes under study ranged from 20% to 76%.
      iv. On average genotype NRL-1929 has absorbed 12% higher Zn than rest of the genotypes at Zn deficient level.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** N.A.
   c. **Ongoing/ awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022)**

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates
Strengthening and enhancing national capabilities for the development of climate smart crops, improvement in animal productivity and management of soil, water and nutrient resources using nuclear and related techniques	CP	IAEA/ Rs. 89 M / 2022-2025

   d. **Submitted funded project: (July 2021 - June 2022):** Nil
   e. **Published Research Paper:**
      Khan P., **M. Imtiaz** and S. A. Ali. 2021. Fertilizer management for improving yield and quality of off-season tomatoes in high tunnel. *Pure Appl. Biol*., 10(4): 1466-1476.
   f. **Event organized (As Organizer/Co-Organizer):** Nil
9. **Training attended:** Nil

10. Summary of the Planned Research Work for the Year July 2022 - June 2023:

i. **Screening of wheat genotypes for Zn efficiency in chelate-buffered nutrient solution**

- Ten wheat genotypes will be screened out for their Zn efficiencies at three levels of Zn activities (2, 10 and 40 pM) in chelate-buffered nutrient solution maintaining pH at 6.0±0.01.
- Two plants of each genotype for each Zn activity will be planted on thermopole sheet floating on nutrient solution.
- Harvesting of the plants will be carried out on day 30 after transplantation and data on different yield parameters will be recorded. The concentrations of Zn, Fe, Cu, Mn and phosphorus will be determined.

ii. **Assessment of zinc extractability of wheat genotypes under field conditions**

- Three genotypes from previous hydroponic study (one Zn-efficient, one medium, one Zn-inefficient) will be tested at three levels of Zn (0, 5 and 10 kg ha^{-1}) for their Zn absorption capability.
- Soil samples will be collected and analyzed prior to initiation of the experiment to select Zn deficient soil.
- Crop will be harvested at physiological maturity and data on different yield parameters will be recorded. Recommendation for the optimum use of Zn fertilizer for wheat will be worked out.

11. Expected Output from the Next Year Planned Research Work:

i. Cultivation of Zn efficient varieties will help to enhance Zn contents in daily diet and reduce the Zn deficiency problem in human.

ii. Identification of Zn responsive cultivars for the situations where farmers can get maximum yield with applied Zn fertilizer.

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure (Rs)
1.	Chemicals for nutrient solution	10 liter (16 nutrients)	5,000/-
2.	Thermopole sheet	-	1,000/-
		Grand Total	6,000/-

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	Chemicals for nutrient solution	-	8,000/-
2.	Thermopole sheet	-	1,500/-
3.	Fertilizers	-	2,500/-
4.	DPLs	20-man days	10,000/-
		Grand Total	22,000/-

Project #: 02

1. **Project Title:** Integrated nutrient management of deciduous fruit (peach) orchards
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Dr. Syed Azam Shah, PS
4. **Team member (Scientists & Staff):** Mr. Parvez Khan, PS
   Mr. Ghaffar Ali, Research Associate
   Mr. Muhammad Adeel Khattak, SA-I

5. **Overall Project Objectives:**
   To develop an appropriate combination of organic and inorganic fertilizers for young deciduous fruit (peach) orchards
6. **Specific Objective:**
   a) To improve the balance nutrition of young deciduous fruit orchards
   b) To develop the best combination of mineral and organic fertilizers for peach orchard
7. **Background and Justification:** Peach) is an important fruit of Pakistan particularly in the province of Khyber Pakhtunkhwa (KP). Yield of peach remains low due to a multitude of factors especially imbalanced use of fertilizers and non-availability of good quality fertilizer products for improving yield and quality of fruit produce. Soils in KP are deficient in plant nutrients particularly N, P, organic matter and zinc (Zn). This deficiency is the major factor responsible for low fruit yield and poor quality. The wide spread deficiency of important nutrients needs fresh appraisal to develop strategies for its management so that net returns from stone fruits can be increased.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Preliminary results indicated that maximum values of height of branches, weight of pruned product and NPK in leaves were obtained with integrated application of mineral N and FYM.
      ii. Soil organic matter, N and available P was improved with the application of FYM**.**
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022):** Nil
   d. **Submitted funded project: (July 2021 - June 2022)**

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
Sustainable Intensification of Plum Production and Soil Productivity through Combined Application of Chemical and Bio-Fertilizers	PI	ALP-PARC/ PKR 3.5 Million	In process
Identification of economical organic mulches for higher water use efficiency, fertilizer N utilization in wheat maize cropping system	PI	PAEC and Turkey/ USD 24000	In process

   e. **Published Research Paper:** Nil
   f. **Event organized (As Organizer/Co-Organizer):** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July 2022 - June 2023:**
    i. Fertilizer (N, P, K & Zn @ 90, 75, 60 & 30 g tree^{-1} respectively) will be applied to experiment
    ii. Data will be recorded for: i) Number of branches ii) Spread of the branches iii) Weight of prune product iv) N, P, K & Zn in leaves and soil samples

11. Expected Output from the Next Year Planned Research Work:

i. Improved soil fertility status comparatively
ii. Improved tree health

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	Fertilizer (NPK)	1 bag	3700/-
2.	FYM	1 trolley	5000/-
3.	Pesticide (Lorsban)	1 bottle	1700/-
4.	DPLs	12 men days	6000/-
		Grand Total	16,400/-

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	Fertilizer (NPK)	1 bag	3700/-
2.	FYM	1 trolley	5000/-
3.	Pesticide (Lorsban)	1 bottle	1700/-
4.	Winter oil	1 bottle	500/-
5.	Calcium oxychloride (COC)	1 packet	2000/-
6.	Calcium carbonate	1 bag	1000/-
7.	DPLs	12 men days	6000/-
		Grand Total	19,900/-

Project #: 03

1. **Project Title:** Improving crop production technology of oilseed brassica
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Mr. Mukhtiar Ali, PS
4. **Team member (Scientists & Staff):** Dr. Amir Raza, PS
   Mr. Ghaffar Ali, Research Associate
   Mr. Muhammad Adeel Khattak, SA-I
5. **Overall Project Objectives:**
   a) To study the effect of low, medium and high levels of fertilizer (NPK) on yield and yield components of brassica
   b) To identify best and suitable NPK level for maximum yield of brassica
6. **Specific Objective:**
   To achieve maximum yield at low inputs
7. **Background and Justification:** Domestic production of oilseed crops in Pakistan fulfills about 30% of edible oil demand and about 70% of the domestic requirements are met through imports at the cost of huge foreign exchange. Brassica oilseeds have the potential to reduce the edible oil import bill if brassica oilseed crops are properly managed. There are many factors responsible for its low yield; one of them is the improper/imbalanced use of plant nutrients/ fertilizer.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** Nil
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022):** Nil
   d. **Submitted funded project: (July 2021 - June 2022)**: Nil

e. **Published Research Paper:**
Tariq M., B. Ahmad, M. Adnan, I. A. Mian, S. Khan, S. Fahad, M. H. Saleem, **M. Ali**, M. Mussarat, M. Ahmad, M. Romman, M. S. Chattha, M. A. El-Sheikh and S. Ali. 2022. Improving boron use efficiency via different application techniques for optimum production of good quality potato (*Solanum tuberosum* L.) in alkaline soil. PLOS ONE, 17(1): e0259403. https://doi.org/10.1371/journal.pone.0259403

f. **Event organized (As Organizer/Co-Organizer):** Nil

9. **Training attended:** Nil

10. **Summary of the Planned Research Work for the Year July 2022 - June 2023:**
    i. Experiments will be conducted to determine best and suitable fertilizer levels for advance brassica lines developed at NIFA during Rabi at NIFA experimental farm to obtain high yield.
    ii. The experiments will be laid out in split-plot design with three replicates. Recommended (40 cm) row to row distance for sowing and other cultural practices will be followed.
    iii. Four fertilizer treatments/levels T0 (No NPK), T1 (30-20-20), T2 (60-40-40) and T3 (90-60-60) (NPK kg ha^{-1}) will be applied in split doses.
    iv. Half N and full PK will be applied at the time of sowing and the remaining half N will applied before flowering at vegetative growth stage.
    v. Data on yield will be recorded to identify suitable level of fertilizers for advance lines of brassica.

11. **Expected Output from the Next Year Planned Research Work:**
    It is hoped that best fertilizers (NPK) levels identified will be helpful for breeders and farmers of oilseed brassica to increase grain yield, oil content, and seed cake production and hence will increase farmer's income. It will also improve the fertilizer use efficiency.

12. **Expenditure and Requirements:**
    Expenditure (2021-22) Nil
    Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	DPL	10 men days	5,000/-
2.	Fertilizers	5 kg	1,500/-
		Grand Total	6,500/-

Project #: 04

1. **Project Title:** Survey of fruit nurseries growing farmers
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Mr. Mukhtiar Ali, PS
4. **Team member (Scientists & Staff):** Nil
5. **Overall Project Objectives:**
   a) To collect information about problems faced by nurseries growing farmers
   b) To find best and suitable solution problems faced by nurseries growing farmers
6. **Specific Objective:**
   To help nurseries growing farming community
7. **Background and Justification:** To help nurseries growing farming community.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Prepared a questionnaire for nurseries growing farmers.

ii. Distributed some of the questionnaire among nurseries growing farmers in the vicinity of NIFA.
iii. Collection data regarding problems and facilities available are in progress.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil
c. Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022): Nil
d. Submitted funded project: (July 2021 - June 2022): Nil
e. Published Research Paper: Mentioned in Project # 03
f. Event organized (As Organizer/Co-Organizer): Nil

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July 2022 - June 2023:

i. Prepared questionnaire for nurseries growing farmers will be distributed among nurseries growing farmers in the vicinity of NIFA.
ii. Information/ data will be collected regarding problems and facilities available in the area.
iii. The collected information/ data will analyzed.

11. Expected Output from the Next Year Planned Research Work:

It is hoped that information will be helpful for best planning for the betterment of nurseries growing farmers in near future.

12. Expenditure and Requirements:

Expenditure (2021-22): Nil
Requirements (2022-23): Nil

Project #: 05

1. Project Title: Collection information of Sour Citrus (Narange) tree plants in NIFA and NIFA experimental farm
2. Funding Source Type: PAEC
3. Principal Investigator: Mr. Mukhtiar Ali, PS
4. Team member (Scientists & Staff): Nil
5. Overall Project Objectives:

a) To study the effect changing climate on available citrus plants in NIFA
b) To study the change in quality and quantity of fruit and plant

6. Specific Objective: Best utilization of available citrus plants at NIFA
7. Background and Justification: Directed.
8. Main findings of the Previous Year (2021-22) Work:

a. Research findings:

i. Counted citrus tree plants in experimental farm as well as within the boundary wall of NIFA.
ii. Information about yield are also collected.
iii. Collected data of the last year are in progress of analysis.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil
c. Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022): Nil
d. Submitted funded project: (July 2021 - June 2022): Nil
e. Published Research Paper: Mentioned in Project # 03
f. Event organized (As Organizer/Co-Organizer): Nil

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July 2022 - June 2023:

i. Any change in counted citrus tree plants in experimental farm or within the boundary wall of NIFA will observed.

ii. Information about yield will also be collected.
iii. The collected information/data will analyzed for further planning.

11. **Expected Output from the Next Year Planned Research Work:** It is hoped that collected information will be helpful for best use of sour citrus available in NIFA in near future.
12. **Expenditure and Requirements:**
    Expenditure (2021-22): Nil
    Requirements (2022-23): Nil

Project #: 06

1. **Project Title:** Improving off-season vegetables production under high tunnels through integrated nutrients and water management
2. **Funding Type**: PAEC
3. **Principal Investigator**: Mr. Parvez Khan, PS
4. **Team member(Scientist & Staff):** Dr. Muhammad Imtiaz, DCS
   Mr. Ghaffar Ali, Research Associate
5. **Overall Project Objectives:** To enhance the production of high value crops under tunnel farming in moisture deficit areas of Khyber Pakhtunkhwa
6. **Specific Objective:**
   a) To manage fertilizer nutrients and water for growing off-season vegetables in high tunnels
   b) To identify economical package of tunnel farming technology for high net return suitable for different areas of KP
   c) To provide training to the farmers for growing off-season vegetables/ high value crops/nursery and their nutrients and water management, etc.
7. **Background and Justification:** The farm productivity and income have greatly reduced due to small land holding, scare water sources, traditional cropping system, low fertilizer and water use efficiencies, etc. The situation demands to adopt modern farming techniques like off-season vegetables / vertical farming under the tunnels and efficient utilization of scarce resources like water, fertilizer, time & space.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. The studies were conducted on nutrients management of tomato (F1: Anna) and cucumber (F1 Hybrid SV -8552). The highest marketable tomato yield (1.78 t/ 10 Marla tunnel) was recorded when NPK @ 75-75-90 kg ha^{-1} was applied at 30 days intervals.
      ii. The maximum cucumber yield (3 t/ 10 Marla tunnel) was obtained by NPK application @ 10-10-15 kg ha^{-1} at 7 days interval through drip irrigation system.
      iii. Foliar application of zinc @ 0.5% to cucumber increased yield by 22%.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** NIL
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):** (July2021-June 2022)

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates
Strengthening climate smart rice production towards sustainability and regional food	CP	IAEA RAS-5093/ 01-01-2022 to 30-12-2025

security through nuclear and modern techniques		

d. Submitted funded Project (s): (July2021-June 2022)

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
Enhancing carbon sequestration, fertilizer nitrogen utilization and climate resilient agro-ecosystem productivity under irrigated potato-maize cropping system	PI	PSF/ Rs. 2.5 M/ 01-01-2022 to 30-12-24	Regretted

e. Published Research Paper/Published :

Khan P., M. Imtiaz and S. A. Ali. 2021. Fertilizer management for improving yield and quality of off-season tomatoes in high tunnel. *Pure Appl. Biol*., 10(4): 1466-1476.

f. Event organized (As Organizer/Co-Organizer):

Event Title	Organizer or Co-Organizer
One day training workshop on "Integrated Nutrient Management for Off-season Vegetables Production in Tunnels" held at NIFA on February 22, 2022.	Co-Organizer

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July 2022-June, 2023:

i. The nutrient requirement of tomato and cucumber will be assessed in high tunnels by keeping plant to plant and row to row distances at 45 cm and 90 cm, respectively
ii. The nurseries of the F1 hybrid will be raised in plastic tubes (6 cm x 4 cm). After thirty days of germination, the nursery will be transferred into the tunnels.
iii. Fertilizer application to cucumber: NPK @ 10-10-15 kg ha^{-1} at 7, 14 and 21 days intervals as fertigation in tunnel with drip irrigation system, which will be compared against the control (no fertilizer).
iv. Fertilizer application to tomato: NPK @ 25-25-30, 50-50-60 and 75-75-90 kg ha^{-1} will be applied to the tomato at 30 days intervals after transplantation till six months, which will be compared against the control (no fertilizer).
v. Total N, available P, K and micronutrients in soil will be determined before sowing and after harvest. Nutrients use efficiency and yield & quality related parameters will be determined.

11. Expected Output from the Next Year Planned Research Work:

i. Reduction in cost of vegetables production by improving fertilizer use efficiency
ii. Enhancing the socio-economic status of small land owners in moisture deficit areas through production of off-season vegetables

12. Expenditure and Requirements:

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure. (Rs)
1.	NPK	61 kg	4,514/-
2.	SOP	6 kg	624/-
3.	Farmyard manure (FYM)	01 trolley	4,000/-

4.	Insecticide	-	7,500/-
5.	Plastic sheet	-	16,438/-
6.	Seed (Tomato and Cucumber)	-	12,000/-
		Grand Total	45,076/-

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	NPK	61 kg	9,150/-
2.	SOP	6 kg	1,800/-
3.	Farmyard manure (FYM)	01 trolley	5,000/-
4.	Plastic sheet and rope	-	25,000/-
5.	Insecticide	-	12,000/-
6.	Seed (Cucumber and Tomato)	-	14,000/-
		Grand Total	66,950/-

Project #: 07

1. **Project Title:** Strengthening climate smart rice production towards sustainability and regional food security through nuclear and modern techniques
2. **Funding Type**: PAEC/ IAEA (RAS-5093)
3. **Principal Investigator**: Mr. Parvez Khan, PS
4. **Team member(Scientist & Staff):** Nil
5. **Overall Project Objectives:** To facilitate the development of climate smart agricultural practices in rice production towards sustainability and regional food security through integrated application of nuclear techniques coupled with modern technologies
6. **Specific Objective:** Nil
7. **Background and Justification:** Climate change and weather variability are exposing global rice production systems to a range of different stresses, including more variable water supply, soil degradation, and heightened vulnerability to damage from more frequent extreme weather events. The projected adverse impacts of climate change on crop productivity could have serious consequences for food availability in the future. There is a considerable need for investment in adaptation and mitigation strategies to soften the adverse effects on food security. One of the alternative ways to meet the goals is by utilizing proven modern technologies in providing science based recommendations for resource efficient crop production management. The proposed climate friendly project will contribute effectively to facing the challenge of the ever increasing demand for rice production.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** 1st year
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI):** (July2021-June 2022)**:** Mentioned in Project # 06
   d. **Submitted funded Project (s):** (July2021-June 2022): Mentioned in Project # 06
   e. **Published Research Paper/Published :** Mentioned in Project # 06
   f. **Event organized (As Organizer/Co-Organizer):** Mentioned in Project # 06
9. **Training attended:** Nil

10. Summary of the Planned Research Work for the Year July, 2022- June, 2023:

i. The study will be carried out at two farmers' fields in Bala Garhi, Mardan with four treatments including (i) NPK @ 150-60-50 kg ha^{-1} (40% of N before transplanting, 40% at tillering and 20% at panicle initiation stage), (ii) NPK & FYM @ 150-40-60-3000 kg ha^{-1} (30% of N before transplanting, 50% at tillering and 20% at panicle initiation stage). All PK and FYM will be applied at land preparation, (iii) Fertilizer control, and (iv) Farmer's practices.

ii. The crop will be harvested at physiological maturity and data on yield parameters will be recorded. Plant and soil samples will be analyzed for N, P & K contents.

11. Expected Output from the Next Year Planned Research Work:

Nutrient management technology will be worked out to withstand the impact of climate change towards a sustainable rice production system.

12. Expenditure and Requirements:

Expenditure (2021-22): 1st year

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	Urea	40 kg	2,500/-
2.	DAP	20 kg	6,000/-
3.	SOP	15 kg	4,500/-
4.	Farmyard manure	01 trolley	5,000/-
		Grand Total	18,000/-

Project #: 08

1. **Project Title:** Assessment of nitrogen and water use efficiencies in wheat through nuclear techniques
2. **Funding Type**: PAEC/ IAEA
3. **Principal Investigator**: Mr. Parvez Khan, PS
4. **Team member(Scientist & Staff):** Dr. Muhammad Imtiaz, DCS
   Dr. Amir Raza, PS
   Mr. Ghaffar Ali, Research Associate
5. **Overall Project Objectives:** To increase wheat production for national food security by efficient utilization of water & nutrients
6. **Specific Objective:** NIL
7. **Background and Justification:** Nuclear techniques of stable isotopes like nitrogen (^{15}N) and neutron scattering moisture probes offer a great prospect to improve nitrogen and water use efficiency, respectively on account of their robustness and effectiveness over conventional techniques. Nuclear techniques will be used to devise strategies for improving nitrogen and water use efficiency of wheat through this experiment
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** 1st year
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded Project (s) (PI/Co-PI): (July2021-June 2022):** Mentioned in Project # 06
   d. **Submitted funded Project (s): (July2021-June 2022):** Mentioned in Project # 06
   e. **Published Research Paper/Published :** Mentioned in Project # 06
   f. **Event organized (As Organizer/Co-Organizer):** Mentioned in Project # 06

9. Training attended: Nil

10. Summary of the Planned Research Work for the Year July, 2022- June, 2023:

i. Nitrogen use efficiency will be determined by applying nitrogen (ordinary and ^{15}N) @ 90,120 &150 kg ha^{-1} in macro & micro plots. Phosphorus & K @ 100 & 80 kg ha^{-1}, respectively will be applied to the entire plot at land preparation, whereas N will be applied in three equal splits.

ii. The water use efficiency will be determined using water balance approach. For determination of moisture changes in soil profile, neutron moisture probe pipes will be installed up to 60 cm depth in each treatment and moisture reading will be recorded using neutron moisture probe.

iii. Crop will be harvested at physiological maturity and data on yield parameters will be recorded.

11. Expected Output from the Next Year Planned Research Work: It is anticipated to bridge the yield gap for wheat production through the development and deployment of modified production technology packages with focus on improving water and nutrient use efficiencies.

12. Expenditure and Requirements:

Expenditure (2021-22): N.A

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	Urea	12 kg	1,000/-
2.	DAP	13 kg	3,000/-
3.	SOP	10 kg	3,000/-
4.	Labeled urea	0.5 kg	50,000/-
		Grand Total	57,000/-

Project #: 09

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 member (Scientists & Staff):** Mr. Shahzada Asif Ali, JS
   Mr. Mushtaq Ali, Research Associate
5. **Overall Project Objectives:** To study long term positive effects of organic farming in comparison with conventional farming practices
6. **Specific Objective:**
   a) To maintain soil fertility through organic farming practices
   b) To develop a package of production technology for organic wheat and potato production
7. **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 the country. 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 in the country.

8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Yield and yield components of wheat and potato differed significantly (*P≤0.05*) between organic and chemical farming systems. Better yield was attained under chemical than under organic farming systems.
      ii. Soils under organic farming systems maintained slightly better contents of organic matter, nitrogen, phosphorus and potassium than those under chemical farming systems.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded project(s) (PI/Co-PI):** (July 2021 - June 2022): Nil
   d. **Submitted funded project:** (July 2021 - June 2022)

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
Pilot scale production and popularization of enriched compost and compost tea	PI	R & D advisory board (PAEC)/ PKR 8.0 M/ 2022-2025	Regretted
Reducing the incidence of smog through identifying and deploying eco-friendly agricultural practices	PI	Pakistan Science Foundation/ PKR 3.0 M/ 2022-2023	Regretted
Mitigating the Impact of Changing Climate on National Food Security Through Improving Soil Fertility and Resilience	PI	International Atomic Energy Agency/ TC Project/ 2024-2027	Decision Awaited

   e. **Published Research Paper:**
   Raza A., Z. Ali and S. A. Ali. 2022. Development and transfer of dual technology of bio-geyser and agro-waste composting. *Pure Appl. Biol*., 11(1): 44-50.
   f. **Event organized (As Organizer/Co-Organizer):**

Event title	Organizer or Co-Organizer
One day training workshop on “Integrated Nutrient Management for Off-season Vegetables Production in Tunnels” held at NIFA on February 22, 2022.	Organizer

9. **Training attended:** NIL
10. **Summary of the Planned Research Work for the Year July 2022 - June 2023:**
    i. Sowing of wheat, maize, sesbania and potato crops
    ii. Harvesting of crops on proper times and recording of data on yield and associated parameters
    iii. Collection of soil and plant samples for chemical analysis in lab
    iv. Data recording on soil water content using Neutron Scattering Moisture Probes from field experiments and subsequent calculation of water use efficiency for wheat crop
    v. Data analysis and report writing
11. **Expected Output from the Next Year Planned Research Work:** Data obtained on comparison of soil and crops under organic and chemical farming systems will contribute towards the development of technology packages for organic wheat and

potato production besides establishing scientific evidence on positive effects of organic farming on maintenance of soil fertility.

12. **Expenditure and Requirements:**

Expenditure (2021-22)

S.#	Item	Quantity/#	Expenditure (Rs)
1.	DPLs	40 men days	20,000/-
2.	Urea, DAP and SOP	-	4,000/-
3.	Weedicide	2 bottles	1,000/-
4.	Maize seed	2 packets	2,200/-
5.	Potato seed	100 kg	8,000/-
6.	Sesbania seed	2 kg	2,00/-
		Grand Total	35,400/-

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	DPLs	40 men days	20,000/-
2.	Urea, DAP and SOP	-	5,000/-
3.	Weedicide	2 bottles	2,000/-
4.	Maize seed	2 packets	2,300/-
5.	Sesbania seed	2 kg	2,00/-
		Grand Total	29,500/-

Project #: 10

1. **Project Title:** Screening of wheat genotypes for water use efficiency using carbon isotope discrimination techniques
2. **Funding Source Type:** PAEC/ IAEA
3. **Principal Investigator:** Dr. Amir Raza, PS
4. **Team member (Scientists & Staff):** Mr. Shahzada Asif Ali, JS
   Mr. Mushtaq Ali, Research Associate
5. **Overall Project Objectives:** To identify water use efficient wheat genotypes using carbon isotope discrimination techniques
6. **Specific Objective:** Nil
7. **Background and Justification:** Existing water crisis and erratic impact of changing climate compels to improve wheat yield particularly under rain-fed conditions. Carbon isotopic discrimination is a robust, fast and reliable screening technique as compared to conventionally used methods to screen genotypes for water use efficiency. Data generated from the study can be helpful in identification of suitable advance lines having higher water use efficiency through the use of carbon isotope discrimination techniques under the ongoing IAEA project.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** 1st year
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021-June 2022)** Nil
   d. **Submitted funded project: (July 2021-June 2022)** Mentioned in Project # 09
   e. **Published Research Paper:** Mentioned in Project # 09
   f. **Event organized (As Organizer/Co-Organizer):** Mentioned in Project # 09
9. **Training attended:** Nil

10. Summary of the Planned Research Work for the Year July 2022 - June 2023:

i. Sowing of replicated trail on wheat (5 advance lines) under irrigated and rain-fed field conditions at the experimental farm
ii. Collection of soil and plant samples and subsequent analytical work under laboratory conditions
iii. Recording of data on yield and yield components
iv. Isotopic analysis for C-13 values from PINSTECH/ IAEA
v. Data analysis and report writing

11. Expected Output from the Next Year Planned Research Work:

Experiment will generate information on water use efficiency of advance lines of wheat that can be used for development of high yielding water use efficient varieties under the ongoing breeding program of the institute.

12. Expenditure and Requirements:

Expenditure (2021-22) N.A.

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1	Chemical fertilizers	-	5,000/-
2	DPLs	20 men days	10,000/-
		Grand Total	15,000/-

Project #: 11

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 member (Scientists & Staff):** Dr. Amir Raza, PS
   Mr. Shahzada Asif Ali, JS
   Mr. Mushtaq Ali, Research Associate
5. **Overall Project Objectives:** To develop N and P rich slow release organic fertilizer (compost)
6. **Specific Objective:**
   a) To enhance N and P content in agro-waste compost using multiple resources
   b) To test efficacy of N and P enriched compost on the performance of leafy vegetables
7. **Background and Justification:** Compost (slow release organic fertilizer) is a good source of plant nutrition particularly for small nursery growers and vegetables producers. Use of compost had added advantages of simultaneously building soil fertility and environmental protection. Existing agro-waste composts are low in N and P contents (about 1-2% and 0.3-0.5%, respectively) that may be increased by enriching the compost using various organic and inorganic sources. There exists research gap on producing N and P enriched compost that may be bridged under this project.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. Research findings:
   i. Analysis of various organic sources of plant nutrition used in nitrogen enrichment of compost depicted that fish bone meal had the maximum N (4.95%) and P (1.2%) contents.
   ii. Analysis of various formulations of enriched composts revealed that the compost prepared from combination of agro-wastes with poultry manure had the highest N content of 1.37%, while the compost prepared by combining

agro-wastes with rock phosphate and filter cake had the highest P content of 0.6%.

b. Crop variety/Patent/Lab Accreditation/Product certification by authorized department: Nil

c. Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022) Nil

d. Submitted funded project: (July 2021 - June 2022): Nil

e. Published Research Paper:

Raza A., **Z. Ali** and S. A. Ali. 2022. Development and transfer of dual technology of bio-geyser and agro-waste composting. *Pure Appl. Biol.*, 11(1): 44-50.

f. Event organized (As Organizer/Co-Organizer): Nil

9. Training attended:

Title	Period	Place
Role of Public Policies for Achieving SDGs (Sustainable Development Goals)	December 20-22, 2021	PARD, Peshawar

10. Summary of the Planned Research Work for the Year July 2022 - June 2023:

i. Collection and subsequent lab analysis of various N and P rich organic/ inorganic materials
ii. Establishment of composting trial comprising of various treatments of selected materials based on analysis
iii. Analytical work on mature enriched compost samples for various parameters particularly N and P contents
iv. Data analysis and report writing

11. Expected Output from the Next Year Planned Research Work:

N and P enriched slow release organic fertilizer (compost) will be developed using different materials. N and P enriched compost may become available to be used by small scale vegetables and nursery growers.

12. Expenditure and Requirements:

Expenditure (2021-22) Nil

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	DPLs	30 men days	15,000/-
2.	Organic/ inorganic sources (farm waste, mushroom spent, rock phosphate, animal manure, fish bone meal, blood meal, slaughter-house waste, poultry manure, sugar industry waste, animal bone meal, wood ash, Urea, etc.)	As per requirement	65,000/-
3.	Plastic sheet	01 roll	Already available
4.	Plastic bags	100 Nos.	10,000/-
5.	Chemicals & glassware	As per requirement	Already available
		Grand Total	90,000/-

Project #: 12

1. **Project Title:** Enrichment of compost tea for its nutritive value
2. **Funding Source Type:** PAEC
3. **Principal Investigator:** Mr. Shahzada Asif Ali, JS
4. **Team member (Scientists & Staff):** Dr. Amir Raza, PS

Mr. Zahid Ali, PS
Mr. Mushtaq Ali, Research Associate

5. **Overall Project Objectives:** To develop nutrient enriched liquid fertilizer (compost tea)
6. **Specific Objective:**
   a) To enrich compost tea through multiple sources of plant nutrition
   b) To test efficacy of enriched compost tea for improving yield of leafy vegetables
7. **Background and Justification:** Compost tea is a liquid fertilizer useful for the production of nurseries and vegetables. Existing compost teas are low in nutrient content and need improvement in their nutritive value through exploitation of available sources of plant nutrition. The current project attempts to develop a nutrient enriched formulation of compost tea that can be used by small farmers involved in nursery raising and vegetables production.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:**
      i. Preliminary findings depicted positive impact of use of humic acid in enriching nitrogen contents of compost tea.
      ii. The nitrogen contents of compost tea were increased from 0.21% to 0.49% through the use of humic acid @ 12.5 g L^{-1} of compost tea.
   b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** Nil
   c. **Ongoing/awarded funded project(s) (PI/Co-PI):** (July 2021 - June 2022): Nil
   d. **Submitted funded project:** (July 2021-June 2022):

Project Title	PI & Co-PI	Funding agency/ total budget/ starting & completion dates	Status
Pilot Scale Production and Popularization of Enriched Compost and Compost Tea	Co-PI	R & D advisory board (PAEC)/ PKR 8.0 M/ 2022-2025	Regretted
Reducing the incidence of smog through identifying and deploying eco-friendly agricultural practices	Co-PI	Pakistan Science Foundation/ PKR 3.0 M/ 2022-2023	Regretted

   e. **Published Research Paper:**
      a) Khan P., M. Imtiaz and **S. A. Ali**. 2021. Fertilizer management for improving yield and quality of off-season tomatoes in high tunnel. *Pure Appl. Biol.*, 10(4): 1466-1476.
      b) Raza A., Z. Ali and **S. A. Ali**. 2022. Development and transfer of dual technology of bio-geyser and agro-waste composting. *Pure Appl. Biol.*, 11(1): 44-50.
   f. **Event organized (As Organizer/Co-Organizer):** Nil
9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July 2022 - June 2023:**
    i. Testing of multiple sources of plant nutrition to enrich the compost tea for its nutrient contents with particular emphasis on nitrogen
    ii. Analytical work to test improvement in nutrient contents of compost tea
    iii. Efficacy study on nurseries of fruit plants (field experiment)

11. **Expected Output from the Next Year Planned Research Work:** Information obtained from study may help to identify suitable sources of nutrition for increasing nutritive value of compost tea. The project is anticipated to produce base line data that can be used in developing a liquid fertilizer product for use by nurseries and vegetable growers after validating the results under field conditions.
12. **Expenditure and Requirements:**

Expenditure (2021-22) Nil

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (Rs)
1.	Aloe vera plants	100 Nos.	5,000/-
2.	Humic Acid	1 kg	25,000/-
3.	Fish powder	5 kg	10,000/-
4.	Indole Acetic Acid	50 g	15,000/-
5.	Kelp powder	5 kg	30,000/-
		Grand Total	85,000/-

Project #: 13

1. **Project Title:** Package of production technology for enhancing national yield of wheat and rice in the country
2. **Funding Source Type:** PAEC/ IAEA
3. **Principal Investigator:** Dr. Muhammad Imtiaz, DCS
4. **Team member (Scientists & Staff):** Dr. Amir Raza, PS
   Mr. Parvez Khan, PS
   Dr. Muhammad Ibrahim, PS
   Dr. Salman Ahmad, SS
   Dr. Hamayoon Khan, SS
5. **Overall Project Objectives:**
   a) Comparison of farmer's existing practice and production technology recommended by agricultural scientists with production technology developed by Dr. Muhammad Zaman
   b) Recommendation of package of production technology to enhance wheat and rice national yield in the country
6. **Specific Objective:** Nil
7. **Background and Justification:** Wheat and rice are staple foods of Pakistan. National yield of these crops is very low compared to reported achievable yield of high yielding approved varieties by agricultural scientists in the country. The low national yield of these crops in the country is due to multitude of factors, mainly because of lower fertilizer use efficiency (Shahzad *et al*., 2019). Yield gaps between national yield and the reported achievable yield of high yielding approved varieties of wheat and rice are about 3900 (3000-4000) kg ha^{-1} and about 6700 (6000-6700) kg ha^{-1}, respectively. The situation of wheat in Khyber Pakhtunkhwa (KP) is even worse as the yield gaps for wheat and rice are about 4500 kg ha^{-1} and about 6000 kg ha^{-1}, respectively (ZTBL, 2020). There exists enormous scope to increase domestic production by narrowing the yield gap between national yield and the reported achievable yield of high yielding approved varieties in the country. Per acre yield of wheat and rice in the country can be enhanced through existing high yielding varieties by providing better production technology (affordable and easy to adopt) through which the growers may enhance their per unit production.
8. **Main findings of the Previous Year (2021-22) Work:**
   a. **Research findings:** 1st year

b. **Crop variety/Patent/Lab Accreditation/Product certification by authorized department:** N.A
c. **Ongoing/awarded funded project(s) (PI/Co-PI): (July 2021 - June 2022)** Mentioned in Project # 01
d. **Submitted funded project: (July 2021 - June 2022):** Nil
e. **Published Research Paper:** Mentioned in Project # 01
f. **Event organized (As Organizer/Co-Organizer):** Nil

9. **Training attended:** Nil
10. **Summary of the Planned Research Work for the Year July 2022 - June 2023:**
    i. Wheat demonstration plots will be established at 5 locations (3 Govt. Agricultural Farms and 2 Farmer's Fields) of KP.
    ii. Three technologies/ practices i.e., farmer's existing practice, production technology developed/ proposed by agricultural scientists in the country and production technology developed by Dr. Muhammad Zaman will be compared along with control (no fertilizer) to find out the best performing one.
    iii. Data on yield and contributing parameters will be recorded at physiological maturity.
    iv. Soil and plant samples will be collected and analysed for relevant parameters.
    v. Data analysis and report writing.
11. **Expected Output from the Next Year Planned Research Work:** The information obtained by comparing the farmer's existing practice, production technology developed/ proposed by agricultural scientists in the country and production technology developed by Dr. Muhammad Zaman will help to identify and recommend the best package of production technology to enhance the overall production of wheat and rice in the country.
12. **Expenditure and Requirements:**

Expenditure (2021-22): N.A

Requirements (2022-23)

S.#	Item	Quantity/#	Appro. Expend. (M. Rs.)
1.	DPLs	1000 men days	1.00
2.	Farm operations	-	0.30
3.	Wheat seed	770 kg	0.10
4.	Chemical fertilizers	-	0.60
5.	Farmyard manure	-	0.10
6.	Pesticides	-	0.05
7.	Consumable stores/ chemicals	-	0.55
8.	POL for vehicles	-	1.00
9.	TA/DA	-	0.50
10.	Miscellaneous/ Unforeseen	-	0.50
		Grand Total	4.70

TECHNICAL SERVICES DIVISION

APP 2022-23 #: 01

1. Name / Designation: Asif Murad Pr. Engineer(Team Leader Electrical Group)

2. Job Description:-

- Ensure Smooth Supply of Electric Power (24/7) to institute / Officer Hostel/ Security Section
  - i) R&M of Electrical Fixtures (wiring / Panels / Breakers ets)
  - ii) Dealing / Coordination with PESCO authorities when required
  - iii) Dealing / Coordination with WASO PAEC when required
- R & M and installation of :
  - i. Security Lights / Cameras
  - ii. Electronics & Scientific Lab Equipment and UPS (24)
  - iii. Computer Hardware (Printers / LCDs)
- Operation / R&M of EPABX (Tele Exchange)
- Convener R&M of AC & Refrigerators Committee
- Convener Committee for In house Calibration of Balances, Thermometer & Glassware
- Cost estimation related to Electrical R/M, Market survey, case indent, Temp. Advance & Store purchase as & when required.

3. Team members name & designation:-

Mr. Muhammad Younas Khan Pr. Tech (Elect)
Mr. Haseeb ur Rehman Sr. Tech (Elect)
Mr. Ajmali Khan Tech-II
Mr. Muhammad Waseem Tech-II
Mrs. Asia Telephone Operator-II
Mr. Muhammad Dayan Tech-II

Assignment carried out during 2021-22:

Convener R&M of AC & Refrigerators Committee

As convener /Technical member of the committee, Monitoring R&M activities of refrigeration appliance, enlisting and priority setting (based on received customized work proforma) of R&M cases, Assessment, Cost estimation, Work execution, Satisfactory Sig from end users on TSD Proforma, Submission of Inspection Report to Administration Division, Store formalities (Return of Replaced parts) for bill processing.

R&M of **51** Refrigeration appliances (ACs / Refrigerators / Water Dispensers) have been successfully carried out since June 2022 under supervision of HVAC Group TSD and committee. Technical & financial Assessment of **20** appliances have also been carriedout by TSD Team / Committee & Approved vendor & are now lying in Admin / Account section for further administrative formalities.

Safety/ Protection Circuit for Automatic Load Management System for Gen. Opr

Automatically Disconnecting AC load on backup generator and Re-connecting on PESCO supply, a mechanism was already operational at various wings of the institute. Three Magnetic Contactors in above mechanism have developed fault (June 2022) due to voltage fluctuations on PESCO line partially disturbing Smooth Electricity flow to various wings linked with faulty Contactors. Coil of these faulty contactor were repaired and safety mechanism for its future operation has been designed, tested & successfully installed.

Technical Member of Transport & Generator Repair Committee

As Technical Member Monitoring & Evaluation of R&M of NIFA Transport & main Generators (03 No). It is worth to mention that aforementioned committee successfully placed 02 No Auto Workshop & 01 No Heavy Duty Generator Repair Workshop on approved rates and on credit basis from local market for timely, quality & cost effective R & M of NIFA transport and Generators.

Re-routing & Replacement of underground damaged Cable

Replacement / Rerouting of damaged underground H.T. Cable & Sagged Conductor (11 KV) on top of Farm shed with Overhead Rabbit Conductor (05No H.T Structure Poles 36 ft high) by PESCO Peshawar. SDO (Opr) Pabbi-III, Xen (Opr) Nowshera City Divsn, Superintending Engineer (Opr) Khyber Circle PESCO Peshawar. Regional Manager (M &T) PESCO Peshawar, Xen SS & TL Kohat Road Peshawar were approached form time to time for successful installation, Testing and commissioning of overhead power line.

Start Date: 08 Feb 2021 Comp. Date :- 27 Sep 2021

Up gradation /Extension of NIFA Telephone Exchange (PTX-310A)

Enhancement of intercom numbers (from 112 to 128 line) & installation of Trunk CLI for incoming Trunk line verification &. Tel. Exchge (12+112) was operational on its full capacity (installed in Sep 2004). ICCC (Manufacturer and supplier of Exchange) was approached for the purpose, Up gradation of Exchange involved purchase of third party items (telephone sets, rozzets, cable etc) from local market apart from propriety item (fully populated Trunk CLI & Subscriber cards supplied by ICCC.

Start Date: 12-02-2021 Comp. Date: 04 -08-2021

Additional Responsibilities (if any):

i) Involved with Head TSD for preparation of scheme & Technical / Development plans for improvement & up gradation of infrastructure and facility via SUMP-II (Special Uplift & Maintenance Prog launched by PAEC Hqr) and Solarization of NIFA for self-sustainability.
ii) Help & support Head TSD in Coordination with other Departments (PESCO, Irrigation, SNGPL & PTCL etc), PAEC Hqtr& other Establishment in Technical matters.
iii) Reply & Corrective Action to Observation /Paras related to TSD domain made during NIFA Performance Audit in July 2021.
iv) Technical member of Condemnation and Disposal Committee. (Study of file/ literature, R&M history of assets of technical nature before its condemnation)
v) Member of TSD Quality Action Team for implementation of ISO 9001:2015 Standards & codes to TSD services and Equipments.

Proposed task / assignments during 2022-23:

i) Supervisory Assignments as Team Leader Electrical
ii) Formation of a Database system for existing Scientific & Electronics Equipments in NIFA for efficient operation and complete R&M History. In phase 2 evolving a strategies for probable repairs of underutilized Equipments.
iii) Improvement and up gradation in the existing Power supply system by addition of solar system 500 KW , Replacement of aged / deteriorated electrical cable network / panels and security light network in institute already included in SUMP-II Prog subjected to its approval from concerned qtrs. and availability of required resources.

iv) Cost estimation, Case indent & Store purchase for arrangement and readily availability of Daily used technical items in NIFA store for day to day R & M services by TSD for Electrical, Mechanical, IT , Mechanical, Plumbing, Carpentry and telephone service.

v) As Operational Officer for Industrial Safety, Installation, Testing & Commissioning of Fire Detection & Alarm System expected after security Clearance of third party)

vi) Manager TPC (Technical Procurement Cell) For Foreign Technical Procurement Through DGSCM (Directorate General for Supply Chain Management)

Technical Suggestion to improve your area of work in institute: N.A

APP 2022-23 #: 02

1. **Name / Designation:** Dr. Muhammad Amin, Principal Scientist (Statistics)
2. **Job Description:** Designing and statistical data analysis of field / lab. research experiments
3. **Team members name & designation**: Nil
4. **Assignments carried during 2021-2022:**
   The technical assistance was provided to all scientists in planning and designing of their field and laboratory research experiments conducted at NIFA. Their experimental data was statistically analyzed related to the projects in Plant Breeding and Genetics, Soil and Environmental Science, Food and Nutrition and Plant Protection Divisions and provided the interpretation of results. This statistical assistance is also provided to the students (working in NIFA as internees) of different universities in their data analysis and other statistical related problems. As Manager ORIC, the outreach activities were executed for dissemination of NIFA products / services and to strengthen the strong coordination with relevant organization and other stake holders.
5. **Additional Responsibilities (if any):**
   a. **Incharge Student Affairs**
      Responsible to look after the student affairs regarding their internships, research works and other analytical services at NIFA.
   b. **Selection & Promotion**
      Working as convener of selection & promotion committee and responsible for selecting and promoting candidates on merit basis.
   c. **Crop Varieties Seed Multiplication Impact**
      As member of this committee, contributing in evaluation and calculation of economic impact of NIFA developed crop varieties.
6. **Proposed Tasks/assignments during 2022-2023:**
   a. **Designing and statistical data analysis of field / lab. research experiments**
      The statistical services will be provided to all scientists working in different research divisions of NIFA. These will also be provided to the internees (students) of different universities working in NIFA.
   b. **Manager ORIC at NIFA**
      The outreach activities will be conducted to broaden our coordination from existing organizations and relevant stake holders to new organizations and farming community. The coordination NIFA research and other divisions will also be enhanced.

c. Incharge Student Affairs

As Incharge Student Affairs, will look after the cases of student affairs regarding their internships, research works and other analytical services at NIFA.

7. Technical suggestions to improve your area of work in institute:

The statistical capacity building of scientists through seminars and hands on trainings on different statistical techniques and softwares.

APP 2022-23 #: 03

1. Name & Designation : Abdul Khaliq, Pr. Scientist
2. Job Description : Management and Supervision of NIFA IT Cell
3. Team members Name & Designations:
   - Mr. Sultan Muhammad, SCO
   - Mr. Ahsan Taqveem, SCT
   - Mr. Abid Munir, Pr. Tech
   - Shahid Zeb, G. Att.
4. Assignment during 2022
   Efficiently managed and managing IT Cell functions
   - Maintenance of LAN
   - Provision of internet access to all the scientists and relevant technical staff.
   - Maintenance of NIFA website
   - MIS webserver enhancement, maintenance and support
   - Provision of audio/visual services
   - Computer/software/Operating system installation and rectifying related problems
   - Improving services for searching research materials both online and printed.
   - Fast fiber optic internet in the institute has been installed and is running
   - Completed Installation of new EAS machine for bio-metric attendance and are working
5. Proposed Task/Assignments of 2023
   - Working for upgradation of institute's Website (Under work)
   - Management of Events to be hosted at NIFA in 2023.
   - Compilation of research and developmental activities of the institute for 2023.
   - NIFA Event Calendar for the year 2023 compilation.
   - NIFA Annual report.
6. Technical suggestions to improve your area of work in institute: NIL

APP 2022-23 #: 04

1. Name & Designation: Jahangir Khan SE

2. <u>Job Description</u>:

i) Ensure Smooth Supply of Water & Gas
ii) Generator Operation & its R&M
iii) Design, maintenance of :
   a) Metal Work
   b) Wood /Carpentry Service
   c) Plumbing Works
iv) Building Civil Work

v) QAT

3. **Team members Name and designation** Mr. Naseem Khan Pr. Tech (woodworks), Mr. Kamran Sr. Tech (Metal Work), Mr. Shahid Ud Din Tech-II (Plumber), Mr. Imran Khan (Mason)

4. **Assignments Carried Out during 2021-22**

i. Replacement of the GI pipe with a diameter of 6 inches and length of 20 feet on the 50 feet tall domestic water supply overhead tank.
ii. Preventive & corrective Maintenance of office building
iii. Renovation of Porch, tilling, whitewash, floor grinding, stair steps repair, marbles fixing on the front steps, and aluminum structure relocation.
iv. Repair work in seed stores,05 No, flooring, structure, and false ceiling.
v. Provided the renovation detail of the office building and related structures for SUMP-II (special uplift and maintenance program) as per MES -SoR (2021) to PAEC HQ for onward submission to SPD.
vi. Whitewash in building's corridors in connection with DG SPD expected visit
vii. Maintain the QMS documents for ISO 9001:2015 and ensured its implementation within the technical services division

5. **Proposed Tasks/ Assignments during 2022-23**

I. Repair and Maintenance of Institute's Buildings and farm field (Civil Work)
   i. Construction of rooms for farm management
   ii. Construction of Supporting wall for Fixing grill in the farm field (500 feet in length)
   iii. Repair of stormwater channels adjacent to a mushroom farm
   iv. Re-levelling roof of main admin store (300 sq. ft)
   v. Fixing tuff tiles in around 6600 sq. ft area in the front of pre-fab seed stores
   vi. Construction of Water course Channels
   vii. Other day-to-day repair work in the institute

II. Repair and Maintenance of institute (Plumbing, Metal Work, and Woodwork)
   i. Arrangement of a kitchen on the first floor of the officer's staff hostel
   ii. Installation of Piping network for the Solar dryer

III. Maintenance and operation of Diesel Generators (125 KVA & 210 KVA), Ensure their availability in case of WAPDA failure

IV. Maintain Documents for Certification of ISO 9001:2015 and QMS Internal Audit

V. Ensure 24/7 availability of utilities (Gas, Water & backup electric supply)

6. **Technical Suggestions**

I. Workforce arrangement for workshop machines operating and welding for effective knowledge management and providing uninterrupted services to the institute.
II. Arrangement of sufficient funds for the preventive & corrective Maintenance of the building

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MINUTES OF THE NIFA's MID-YEAR REVIEW (MYR) 2021-22 PROCEEDINGS

Mid-Year Review of four research divisions of NIFA was held on March 31, 2022. NIFA Research Planning and Evaluation committee (RP&EC) along with both Director General and Director (A&B) from PAEC HQ, Islamabad attended and chaired Mid-Year Review proceedings. Laboratory and field experiments progress of all research groups of four divisions was inspected and monitored as per approved annual research program 2021-22. During proceedings, NIFA RP&EC and both dignitaries from PAEC HQ were briefed about the current R& D activities by relevant scientists working in four research divisions. The description of proceedings is as below.

FOOD & NUTRITION DIVISION

Food Engineering and Irradiation Group

Group leader described the work to develop simple and low-cost technology for astringency removal from persimmon fruit using different approaches like the effect of packing material, packing material color, chamber treatment and storage stability. Results on different parameters have been compiled. Study on value addition of low-quality citrus sources for the preparation of nutritionally enriched juice blends was carried out. Evaluation of developed product as ready to serve (RTS) drink through organoleptic evaluation along with physiochemical analysis for storage stability is in process. Tomato paste was prepared and compared with Iranian and Chinese made tomato paste available in the market. Further study is in progress.

Studies under IAEA funded project on "Adaptation of low energy machine generated radiation sources for surface decontamination and disinfestation of food in Pakistan" included the irradiation of pine nuts samples with target doses of 1, 3, 5 and 7 kGy using Co-60 source of gamma and low energy x-rays from RS-2400 irradiator source respectively. Sensory evaluation, compositional analysis, peroxide value, fatty acid profile and total fungal counts were carried on day first and after two months interval for a storage period of six months. New project entitled "Development of hybrid indirect type solar dryer for drying of fruits and vegetables" is awarded to the group by PARC, Islamabad and work on the design of the dryer has been initiated.

Food and Environmental Safety Group

Commercialization progress of mushroom was described by the group leader. Mentioning that mushroom cultivation technology was popularized through demonstration of cultivation phases to new farmers at NIFA mushroom farm and provision of mushroom spawn for developing their own mushroom farms. NIFA Ganoderma mushroom was analyzed phytochemically from PCSIR Laboratories Complex Lahore for identification and quantification of biologically active constituents (Triterpenoids, polyphenols, minerals and vitamins). Data recording on experiment of Ganoderma cultivation optimization/efficient compost identification is in progress. Progress on bio-pesticides (Plant extracts) both emulsified and non-emulsified along with synthetic pesticide as positive check were sprayed in two-week interval in a planned wheat field experiment (Morocco Var.) for the management of yellow rust.

Data recording on yellow rust for evaluation of comparative efficacy of bio-pesticide is in progress.

Progress on the study of production and application of bacteriocin as a bio-preservative included that molecular weight of bacteriocin and S-layer cell wall protein analysis of selected stains, Tricine Sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) was performed in Food Microbiology NIFA. It was observed that there was phenotypic relationship among the selected strains for S-layer protein pattern. The selected strains produced varying numbers of major protein bands (7-10), with molecular weights between 30 and 72 kDa. Progress on quality evaluation of honey included standardization of different protocols. So far, protocols for estimation of ash contents, pH/ Acidity, moisture contents, Hydroxymethyl Furfural (HMF), inverted sugar and flame tests have been standardized.

Food Nutrition Group

Group leader described progress under low cost zero-energy chambers project. Zero Energy Cooling Chamber (ZECC) technology was popularized by holding training workshops at Haripur and Swat districts. A large number of farmers (150 no.) participated in these training programs. Furthermore, storage study of spinach was carried out in ZECC and results showed that spinach had a shelf life of 05 days inside ZECC as compared to 02 days at ambient temperature. Under IAEA project entitled "Strengthening national capabilities to mitigate vitamin A deficiency in the Pakistani vulnerable population using stable isotope techniques" several minor equipment (Centrifuge, pH meter, Orbital Shaker, Flask Shaker, Micro Lab analyzer etc.) were received. Moreover, stability of vitamin-A in oils/ghee samples during frying, 05 different ghee samples were analyzed under the project. All samples were subjected to five times frying for different time durations. Results showed that vitamin-A was destroyed after 4^{th} frying in all ghee samples.

Progress on the development of rapid test kit to check rancidity in fats/oils, 03 different treatments were prepared and stored at three different temperatures T1 (inside the lab at 25±5 ^{0}C), T2 (outside the lab under uncontrolled atmospheric conditions) and T3 (in a refrigerator 2-4 ^{0}C) for 05 months. Among these treatments, treatment T1 gave best results for rancid color production in 04 different types of oil/ghee samples. Therefore, treatment T1 was further selected for stability studies. Along with the R& D work, dissemination of the subject kit is in progress via dispatching letters and emails to relevant stakeholders. Kits packaging material preparation is also in-process. On Spot Tests have been developed and optimized to determine foreign dyes (Sudan Red & Raspberry Red Blend) in red chili and metanil yellow in turmeric powder. Sensitivity tests were performed and different concentration of foreign dye (1, 5 and 10%) in red chilli and turmeric were detected successfully. Wheat Flour samples from districts Peshawar and Nowshera were collected and analyzed to check Iron fortification status using both Lab developed and Reference methods. ISO-17025 documents for Iron determination method were prepared including QM, WIs, SOPs, LMPs, and RCDs. Moreover, wheat flour sample were dispatched to Qarshi Research International Pvt. Ltd. Haripur, Khyber Pakhtunkhwa and PCSIR Laboratories Complex, Karachi Labs for Inter Lab comparison.

PLANT BREEDING & GENETICS DIVISION

Wheat Irrigated Group

Wheat irrigated group's research experiments/trials were planted as per approval Annual Research Program 2021-22. The trials included National Uniform Yield Trial (NUYT) with 70 lines, Khyber Pakhtunkhwa Wheat Yield Trial (KPWYT) with 42 lines, Micro Plot Trial (MPT) with 22 lines, 03 Advanced Yield Trials (AYTs) with 60 lines, 03 Preliminary Yield Trials (PYTs) with 66 lines and 06 International nurseries. DUS data regarding CTHN-162056 (1st year mandatory evaluation in NUWYT) is in progress in coordination with FSC & RD. Relevant data of various parameters including days to heading, tillers/m^2, pant height, incidence of yellow rust, leaf rust and loose smut were already recorded. Remaining parameters/characters data will be recorded in due course of time. In addition, progeny rows and blocks of the irrigated varieties were being screened for production of BNS. Five different cross combinations were attempted and evaluation of segregating populations is in progress (F_2 –F_5, M_1 – M_4).

Wheat Rainfed Group

A total of 781 entries having different genetic background were planted for grain yield evaluation, disease resistance and other agronomic traits in different yield trials (KPWYT, PYT's, AYT, 29th SAWYT, 11th SATYNDRGT, NIBGE Cor Trial – I, NIBGE Cor. Trial – II) and non-replicated nurseries (39th SAWSN, 4th NWON) at NIFA farm under rainfed conditions. Parameters data on days to heading, yellow rust, chlorophyll content and NDVI were completed. Other agronomic parameters data including plant height, days to maturity and yield will be recorded in due course of time. Crosses were attempted between resistant cultivars/genotypes to develop high yielding and disease resistant varieties. In addition, desirable recombinants/mutants had been selected in different generations (F_1 / M_1). For pre-basic seed production, NIFA Lalma, NIFA Insaf, NIFA Awaz and NIFA Aman were planted on 14 acres. First field inspection by FSC&RD was completed. Necessary roughing in seed multiplication blocks is in progress. DUS studies for candidate line NRL1664 has been completed during 2020-21 and 2021-22 while NRL 1812 and NRL 1825 were subjected for 1st year mandatory DUS studies during 2021-22. DUS proforma of these candidate lines duly signed by Seed Certification officer FSC&RD have been received.

Oilseed and Brassica Group

In case of oilseed brassica, 92 genotypes at station, 08 genotypes in the zonal adaptability and 105 genotypes in the national trials inclusive of 05 NIFA rapeseed elite lines had been planted at NIFA to evaluate for yield and other related traits. The data on the days to flowering, days to maturity and plant height had been recorded. Furthermore, DUS studies of 02 candidate lines one each of mustard and rapeseed for field related traits had been recorded in coordination with FSC&RD on 18th March, 2022 while rest of the traits were to be recorded after harvesting. Regarding quality seed production, NIFA Sarson-T20 had been planted on 0.35 acre at NIFA and the field crop inspection had been conducted by the FSC & RD. Likewise, progeny rows and progeny blocks of all released rapeseed and mustard varieties had been planted for maintenance of genetic purity.

Horticulture Group

24 plants of two exotic accessions (PW & Z-4) were under evaluation for early maturity in orchard. Flowering, sprouting and fruit setting data had been recorded in exotic germplasm. Other parameters i.e., fruit characteristics were to be taken in due course of time. Local peach germplasm comprising of 20 plants was to be evaluated for desirable characters. The initial agronomic parameters i.e., plant height (cm), internode length, number of nodes per branch, number of leaves per branch, and stem diameter (cm) of individual mutants derived from Early Grand and Florida king had been recorded and fruit character data was in progress. The experiment on the effect of bio char on the peach nursery regarding replant disorder were being carried out. The data regarding germination was in progress.
Genetic variability in 7 mutant plants of plum were being carried out in orchard. The sprouting data on these mutant plants had been recorded. Other parameters like number of branches, height and internode length were to be recorded in due course of time. Black plum bud wood irradiated with 30 Gy treatment for creation of genetic variability had been budded on the Mariana rootstock in the nursery.

Pulses Group

In case of chickpea, heat tolerance trial comprising of 20 elite chickpea genotypes had been planted in the field under PSF Chickpea project to screen the genotypes for physiological traits for heat tolerance under field conditions. Data at flowering and podding stages had been recorded and the data at grain-filling stage was to be taken in due course of time. Common bean adaptability trial comprising of 11 genotypes had been planted in field in spring 2022. The trial was at seedling stage with good crop stand. 0.4 acre had been planted with BNS of 02 common bean varieties i.e. NIFA Lobia Red and NIFA Lobia Yellow. Similarly, BNS of mungbean varieties ‘NIFA Mung Ramzan, NIFA Mung-19, NIFA Mung Spinghar-21 and NIFA Mung Sikaram-21 had been planted on 1.5 acres.

PLANT PROTECTION DIVISION (PPD)

Plant Pathology Group

Group leader explained the progress of field and lab experiments being carried under approved program 2021-22 under the project “wheat crop monitoring for pathogens, aphid and seed health issues”. Different rust parameters data of wheat differentials, National Wheat Disease Screening Nursery (NWDSN), National Candidate Wheat Varieties and post-release monitoring of commercial varieties is under progress. Seed health risk analyses data of 150 commercial varieties was completed.

Biocontrol Group

Group leader described number of experiments being carried under IAEA project “Integrated management of fruit worm, *Helicoverpa armigera* (Hub.) through egg parasitoid, *Trichogramma chilonis* (Ishii.) with Sterile Insect Technique (SIT) in high tunnel tomato”. Egg parasitoid, *Trichogramma chilonis* (Ishii) is being maintained on host eggs of *Sitotroga cerealella* (Oliv.). Preliminary study on parasitizing potential of *T. chilonis* with bio-pesticides against fruit worm in is under progress. Effective rearing

of tomato fruit worm, *Helicoverpa armigera* (Hub.) on different artificial diets and Improvement of egg parasitoid, *Trichogramma chilonis* (Ishii) culture on host eggs of Angoumois grain moth, *Sitotroga cerealella* (Oliv.) reared on different stored cereals.

Different wheat germplasms under National Program are being evaluated against aphid population and data will be completed in due course of time. DG (A&B) took keen interest in bio-pesticide studies and mentioned the high demands he had been receiving for bio-pesticides from various companies including Auriga. He stressed to develop a bio-pesticide based product for commercialization.

Medical Entomology Group

Group scientists described the progress of their approved experiments under the project "Integration of conventional and novel techniques for the development of environment friendly management strategies against mosquito vectors". After listening details in the medical entomology lab, DG (A & B) advised medical entomology group to prepare a comprehensive briefing by highlighting the collaboration with IAEA and its role in the establishment of existing mosquito rearing laboratory at NIFA. DG (A & B) stressed the need to prepare a list of tangible achievements/future plans regarding Dengue vector control in Pakistan. Dr. Inam, PS was also advised to prepare an orientation for DG SPD regarding development history of dengue guard and its ongoing registration process. The group was instructed to highlight their role on provincial and national level and also clearly mention their needs in terms of equipment or funds (if any) for the improvement and research of medical entomology.

Termite Control Group

Group scientists described detailed progress of experiments for anti-termite product and bait matrix development under the approved annual research program 2021-22. DG (A & B) advised termite group to prepare a comprehensive briefing of termite group activities since its inception for briefing to honorable DG SPD. He stressed to prepare highlights of various assignments accomplished by the group with respect to termite management such as termite control in Sheesh Mahal (Shahi Qila) Lahore, Shalimar bagh Lahore, Taxila museum, Kohat and Islamabad Golf clubs etc.

Fruit Fly Group

Group scientists highlighted progress of experiments being carried under approved annual research program 2021-22. It was realized that the group is strengthened after the arrival of Dr. Hamayoon, SS from NIA Tandojam.

SOIL & ENVIRONMENTAL SCIENCES DIVISION

Plant Nutrition Group

Group leader described progress on bio- fortification and highlighted the project objectives and explained the work done under this project so far. He told the committee that the hydroponics experiment on wheat was executed and now the experiment has been harvested. The data on dry matter yield and yield attributes have been recorded.

The plant samples have been prepared for analytical work. The study on nutrient management of young (non-bearing) deciduous fruit orchards was also described. Soil and plant samples have been collected and analytical work is in progress.
R & D studies on improving off-season production of tomato and cucumber in tunnels was also explained by the group leader. The crops are growing well and exhibiting response to the respective treatments.

Soil Biology & Biochemistry Group

Group Leader presented ongoing research projects on monitoring long term impact of conversion to organic farming and development of enriched compost and compost tea. The activities under the projects have been executed as per plan. The field experiment on organic wheat and potatoes is performing well. Analytical work on identification of materials for enrichment of compost and compost tea are in progress. It was anticipated that a good product may be developed for use by small nursery and vegetable growers.
NIFA Research Planning and Evaluation committee (RP&EC) along with both Director General and Director (A&B) from PAEC HQ, Islamabad appreciated the overall efforts of scientists of the institute in executing R&D activities of the approved research plan on time. Committee directed all scientists to complete entire field/lab related data collection and analytical work on time for remaining part of the year to complete planed annual research program approved for 2021-22.

NIFA ANNUAL IN-HOUSE REVIEW AND RECOMMENDATION FOR THE YEAR 2021-22

Annual In-house review of research projects of the scientific divisions was carried out by the Research Planning & Evaluation Committee (RP&EC) from 16 to 19 August 2022 in NIFA auditorium. Each scientist presented his work. The Research Planning & Evaluation Committee (RP&EC) was comprised of;

1. Dr. Gul Sanat Shah, DCS, Director
2. Dr. Muhammad Imtiaz, DCS, Head SE &SD (Member)
3. Dr. Syed Jawad Ahmad Shah, DCS, Head PPD (Convener)
4. Dr. Maazullah Khan, DCE, Head FND (Member)
5. Dr. Roshan Zamir, DCS, Head PB & GD (Member)

RECOMMENDATIONS

SOIL & ENVIRONMENTAL SCIENCES DIVISION

In-House Review (IHR) of S & ESD was held on 16 August 2022 in NIFA Auditorium.

Responding to a query by RP&EC, Dr. Muhammad Imtiaz, DCS informed that representative soil samples from selected blocks of land at the experimental farm have been analyzed for physical-chemical properties based on suggestions made during last year review. Additional and detailed soil analysis can be arranged based on request of any scientist for their ongoing projects. It was proposed by RP&EC to breeders for sharing those advance lines of wheat that are expected to be part of NUWYT for screening for zinc efficiency so that data from hydroponic studies can be useful in release of zinc efficient varieties as well. The committee also suggested to extend hydroponic studies to field scale. Dr. Muhammad Imtiaz, DCS informed the house that we have plans to extend zinc efficiency trials to field scale under ongoing comprehensive IAEA TC project and looking forward to finalize details of collaboration with fertilizer companies in our upcoming meeting with Dr. Muhammad Zaman, Technical Officer, IAEA. RP&EC emphasized that SE&SD is lacking marketable product and technology. The scientists working in SE&SD need to review their R&D activities according to the need of the day and demand of authorities.

Dr. Azam Shah presented his R&D activities of last year. The RP&EC instructed Dr. Syed Azam Shah, PS to identify research gaps in addressing nutritional requirements of young peach and plum plants in consultation with relevant scientist of provincial research/farmers practice with proper contact detail and submit a brief report as the said report has been awaited since last annual review. He was further directed by the committee to initiate R&D for development of bio-based bio-fertilizer for orchard and submit project for funding in this regard.

Mr. Mukhtiar Ali, PS presented data collected regarding fruit nurseries raising and citrus data. He was suggested by the committee to study effect of changing climate (specific parameters e.g. temperature, rainfall etc.) on yield and performance of selected citrus plants at the farm and publish data.

Mr. Parvez Khan, PS presented his tunnel related R&D activities conducted during 2021-22. He was suggested to prepare and submit a brief report on socio-economic impact of tunnel technology by interacting with farmers who had been the beneficiaries of the techniques disseminated by NIFA.

Dr. Amir Raza, PS/Group Leader presented his last year R&D work on organic farming. The RP&EC proposed Dr. Amir Raza, to intensify efforts for developing a product for nursery growers. Responding to the suggestion of committee, Dr. Amir Raza informed the house that group is now working on enrichment of compost and compost tea for their nutritive value. But, the availability, affordability and extraction protocols remain a challenge towards exploitation of existing natural sources of plant nutrition towards the development of an organic fertilizer product. The group scientists hope to develop a product within next 3-4 years.

Mr. Zahid Ali, PS provided detail of R&D activities conducted on compost tea. RP&EC suggested him to use spent mushroom in the development of agro-waste compost.

FOOD AND NUTRITION DIVISION (FND)

In-House Review (IHR) of FND was held on 17 August 2022 in NIFA Auditorium.

Food Engineering and Irradiation Group

Dr. Maazullah Khan Head FND/DCE presented overview of Food and Nutrition Division followed by his R&D results on “mitigation of post-harvest losses and value addition of fruits and vegetables”. He dilated upon the removal of astringency from persimmon fruit by using efficient and low-cost packaging material as well as progress on the development of solar drier. Director NIFA asked him to share 1-2 page brief on the development of solar drier.

Mr. Muhammad Zubair Shah, PE presented his research work on the “development of technology for astringency removal of dates and study of storage life extension”. He shared important achievements related to optimized process parameters of the astringency removal of Dhoka and tomatoes puree. The RP & EC suggested to visit DI khan for selection of homogenized samples of dhoka dates for better comparative results.

Mr. Alamgeer Khan, SS explained the R&D work carried out on the “adaptation of low energy machine generated radiation sources for surface decontamination and disinfestation of food in Pakistan”. He shared the significant findings on irradiation of pine nuts related to sensory evaluation, microbiology and nutrient content. Director, NIFA directed him to prepare 1–2-page summary of the previous and current project regarding its socioeconomic impact.

Mr. Asim Irshad, JS briefed the house about his work on the “development and optimization of rapid tests for foreign adulterants in food”. He said that he has achieved encouraging results for determination of foreign dyes in red chili powder and turmeric powder through rapid testing. However, Director NIFA/ The RP & EC instructed him to plan research work aligned with the goals of food engineering group during the next year (2022-23).

Food and Environmental Safety Group

Dr. Muhammad Ibrahim, PS highlighted his R&D efforts on the “commercialization of mushroom (oyster milky and button) through popularization as cottage industry and cultivation of Ganoderma/Reishi medicinal mushroom on low cost substrate”. The RP & EC suggested him to carry out a cost/benefit analysis and reduce the input cost on the production of mushroom spawn.

Dr. Talat Mahmood, SS apprised the house about his R&D on the “production and application of bacteriocin as a bio-preservative and characterization of producer strains as potential probiotic cultures and Quality evaluation of Honey for establishing honey testing facilities at NIFA”. Director NIFA/ The RP & EC suggested him to share 1-2 page report on the comparative difference between his R&D efforts and NIBGE work on probiotics as well as feasibility of honey testing at NIFA.

Food and Nutrition Group

Dr. Zahid Mehmood, PS shared the key findings related to optimization of storage conditions for different fruits / vegetables under ALP funded “Development of low-cost zero-energy cooling chamber for field heat removal and storage of fruits and vegetables, and its transfer to small farmers”. While explaining the house about his other IAEA funded project on “Establishment of nutrition assessment lab using non-radioactive isotopes to mitigate the micronutrient deficiency in the Pakistani vulnerable population” he shared the data related to presence of Vitamin-A in commercially available cooking oil samples. Director NIFA appreciated his work and suggested him to share a 1-2 page future plan for popularization the ZECC technology among local farming community.

Mr. Ali Raza, SS briefed the house about his research work on “development of rapid test kit (RTK) for qualitative determination of Peroxide Value (POV) in oil/fats”. Director NIFA commended his work and instructed him to develop coordination with the KP Food Safety and Halal Food Authority for dissemination of the developed kits.

Mr. Tauqeer Ahmad, JS shared key findings of his research carried out on the “Method optimization and assessment of fortified iron in wheat flour samples”. He also shared the status of iron content in wheat flour samples collected from district Peshawar and Nowshera. Director NIFA appreciated his work and enquired him to share the progress on ISO 17025 accreditation for iron determination method.

PLANT PROTECTION DIVISION (PPD)

In-House Review (IHR) of PPD was held on 18 August 2022 in NIFA Auditorium.

Plant Pathology Group

NIFA Research Planning & Evaluation Committee appreciated the role of Dr. Syed Jawad Ahmad Shah as Head PPD for rich number of publications in scientific journals and ongoing and submitted projects at divisional level.

Biocontrol Group

Mr. Muhammad Zahid was advised to apply LSD or DMR at a time in his data. He was also advised to prepare a report highlighting the hurdles and problems in Tricho-cards marketing and commercialization. While referring to R & D work of his group on bio-pesticides, RP & EC instructed him to develop a marketable bio-pesticide based product with time frame.

Mr. Usman Khalique was also advised to apply LSD or DMR in his data. He was also advised to see aspect of commercialization and income generation before starting a new project to avoid problems at a later stage. RP & EC emphasized the need to develop bio-pesticide product within a given time frame. He was also suggested to always mention local name of botanicals for better understanding of audience.

Medical Entomology Group

Dr. Gul Zamin Khan was advised not to mention local committee membership in the in-house review slides. He was asked to design and develop a marketable trap from his lethal ovitrap studies as desired by DG A&B for commercialization by fulfilling all formalities. He was also advised to prior search and identify potential registration agencies for parthenium based biopesticide to avoid hurdles and post product development complications. He was also advised by the committee to address the critical issue of parthenium raw material for production of biopesticide.

Dr. Inamullah Khan, PS was advised by the NIFA RP & EC to share all his efforts in documented form that he has so far made for the registration of Dengue guard house fly guard. He was also asked to provide data regarding trademark registration of Dengue guard with IPO. He was further advised to complete his homework for infrastructure development, equipment and other necessities that might be needed for Dengue guard production on commercial level once the registration process completes. He was also suggested to use blue color scheme along with PAEC monogram on Dengue guard sticker for attractiveness and enhanced marketability.

Termite Control Group

Dr. M. Misbah ul Haq PS was advised by the committee to see feasibility of including G1 garlic in his upcoming trials against termites as the same is reported to have high medicinal benefits. Committee advised him to identify issues and hurdles in NIFA-Termap commercialization. RP & EC suggested him to identify active ingredients in clove and garlic. Dr. M. Misbah highlighted the need for involving a certified chemist in his studies regarding development of bio-pesticide for termite management. Director NIFA assured his full cooperation in this regard.

Mr. Muhammad Irfan JS, was asked to mention the time frame for the development of bait-matrix for termite management and explore opportunities for its marketability.

Fruit Fly Group

Dr. M. Hamayoon Khan SS was advised to develop collaboration with fruit growers for strengthening fruit fly programs in terms of income generation from fruit fly traps.

Mr. Muhammad Salman was asked to complete his paper on Degree Day Model developed by him and submit it to a journal after internal evaluation as soon as possible. He was also encouraged to submit project proposal as P.I to donor agencies for funding for initiating field studies

PLANT BREEDING AND GENETICS DIVISION (PB&GD)

In-House Review (IHR) of PB & GD was held on 19 August 2022 in NIFA Auditorium.

Horticulture group

Dr. Roshan Zamir DCS presented scientific finding/results on his R&D work on plum in the nurseries and orchards. He explained the results of experiments on budding of 03 varieties (Beuaty, F Manani and Santarosa) using different PGRs (IAA, IBA and GA3). In orchard 04 Local germplasm of plum along with mutants were also evaluated for adaptability. The RP & EC advised him to provide Sketch/lay out of the plants in the orchard for record and presentation to higher authorities.

Mr. Shahid Akbar Khalil, PS, presented scientific finding/results on his R&D work on peach orchards, and biochar experiments conducted under PSF project in the year 2021-22. During discussion session The RP & EC advised Mr. Shahid Akbar Khalil to prepare and submit a detailed report on biochar related research work elsewhere in Pakistan. The committee further advised him to provide details of peach experimental material with sketch through HoD. The RP & EC also advised Mr. Shahid Akbar Khalil to submit a detailed report on stevia regarding adoption of stevia by growers as a crop with acreage under this crop on farmers' fields as well cost benefit detail-of-production at NIFA.

Oilseed Brassica group

Mr. Hafiz Munir Ahmad, PS, presented results of his 2021-22 R&D work on, "Improvement of oilseed Brassica through induced mutations and hybridization techniques". In discussion session, The RP & EC advised Mr. Hafiz Munir to submit a written justification of Brassica group in NIFA to the committee which was still awaited. He was also advised to provide complete details of Brassica varieties seed sold to growers/seed companies on proforma particularly designed for this purpose and circulated to all breeders of the PB & GD.

Mr. Khurshid Ahmad shared scientific results of his individual 2021-22 R&D work on "Creation of genetic variability, handling of early breeding generation and quality analysis of oilseed Brassicas". The RP & EC pointed that Mr. Khurshid Ahmad was under-utilized and may therefore be placed in a research division/group so as to better utilize his potential. He was also advised to provide quality analyses of significantly higher yielder genotypes as well as checks in local, zonal and national trials through HoD.

Wheat irrigated group

Dr. Muhammad Irfaq, PS, presented results of his R&D work on, "Replicated yield trials and segregating populations conducted during 2021-22. RP & EC directed Dr. Muhammad Irfaq Khan to come up with a candidate line(s) from breeding material generated through hybridization/induced mutation for inclusion in NUYT up to 2025. Dr. M. Irfaq also informed that the candidate line CTHN-162056 showed low yield in NUYT this year and low level of resistance. He was advised to submit and get funded projects as well publish research articles in peer-reviewed journals from his core project as these achievements were lacking on his part. The committee showed dissatisfaction for paying Rs. 10,000/- fee to FCSRD without conducting DUS of candidate lines CTHN-162056 and CTHN-172114 during 2021-22. The committee reiterated that each breeding program will conduct DUS for every entry included in NUYT with the help of official from regional office of FCSRD, Peshawar. Fee will be deposited for that line which produce required higher yield than check in NUYT. However, DUS will be mandatory for each entry included in NUYT at NIFA.

Dr. Syed Tariq Shah presented 2021-22 results of exotic and indigenous materials evaluated in nurseries and trials. He also shared information regarding evaluation of Chinese and local wheat material through joint project with Chinese counterpart under one-belt-one-road initiative. The RP&EC appreciated Dr. S. Tariq Shah for his research activities as well as out-reach endeavors. He was advised by committee to include his best line for evaluation in KPWYT next year.

Wheat rainfed group

Dr. Farooq-e-Azam, PS, presented scientific results of his 2021-22 research activities as well as seed quality wheat seed production data. Dr. Farooq-e-Azam also informed the house regarding a wheat candidate variety proposal's submission to the Technical Sub-Committee of KP Seed council in near future. During discussion, the RP & EC highly appreciated Dr. Farooq-e-Azam for presenting comprehensive data of wheat seed distributed to AED, KP in the year 2021-22 and advised all other breeders to follow. The committee noted lack of funded projects and published research papers on the part of Dr. Farooq-e-Azam and advised him to improve these deficiencies in future. He was also advised to establish plant physiology lab and start stress physiology work on wheat.

Dr. Salman Ahmad, SS, presented results of his R&D work carried-out during 2021-22. RP & EC pointed towards Dr. Salman's deficiency regarding funded projects and published research articles. He was also advised to submit projects particularly on wheat stress physiology.

Dr. Akhtar Ali, SS, shared result of his individual R&D endeavors carried-out in 2021-22. Dr. Akhtar Ali also shared information regarding NIFA's wheat varieties seed production and management. The RP & EC advised Dr. Akhtar Ali to share cost of production of wheat varieties seed at NIFA in the year 2021-22. The committee also advised him to submit projects for funding particularly regarding climate change impact on wheat productivity.

Pulses group

Dr. Iqbal Saeed, PS, shared results and tangible findings of mungbean and chickpea R&D work in 2021-22. Dr. Iqbal Saeed also shared data of NIFA mungbean varieties seed distribution to AED, KP in 2021-22. The RP & EC appreciated Dr. Iqbal's endeavors for collecting FSC & RD seed lot No. for mungbean varieties seed produced by AED, KP at Kurram and D.I. Khan. The committee advised Dr. Iqbal Saeed to submit more research projects for funding as the already ones were going to be completed in coming two years.

Mr. Shahzad Ahmad, JS, presented results of his individual R&D project on, "Improvement of common bean for yield and yield components". Mr. Shahzad Ahmad also informed the house about approval of 02 high yielding common bean varieties 'NIFA Lobia Red-22 and NIFA Lobia Yellow-22' by the KP Seed Council in January, 2022. The RP & EC appreciated R&D work of pulses group. The committee advised Mr. Shahzad Ahmad to submit a project for funding particularly on heat tolerance in common bean. The committee also encouraged him to publish articles from his research work.

RP & EC strictly advised each PB & GD breeder to provide complete data of seed produced under his program at NIFA, and distributed for further multiplication by AED, KP/Seed companies etc on proforma particularly designed and already circulated for the purpose mentioning gate pass details with date, FSC & RD lot No. and category of seed produced at NIFA as well as at other locations by AED/Seed companies etc.

Further, each research group leader of PB & GD shall be responsible for fabrication/maintenance of iron display boards for each category of breeding material under his program. Display boards should be fabricated well in time before planting experiment and grain production data should not be presented during inhouse review.

NIFA ANNUAL RESEARCH PROGRAM REVIEW AND RECOMMENDATIONS FOR THE YEAR 2022-23

Research programs of the R &D divisions were reviewed by the Research Planning & Evaluation Committee (RP&EC) in its meetings held in NIFA conference room from 20 to 23 September 2022. The RP&EC was comprised of;

1. Dr. Gul Sanat Shah, DCS, Director
2. Dr. Muhammad Imtiaz, DCS, Head SE&SD (Member)
3. Dr. Syed Jawad Ahmad Shah, DCS, Head PPD (Convener)
4. Dr. Maazullah Khan, DCE, Head FND (Member)
5. Dr. Roshan Zamir, DCS, Head PB&GD (Member)

GENERAL RECOMMENDATIONS

1 Submitted/awarded/on-going funded projects, products registration, patents, lab accreditation correspondence should be shared in soft with both HoD and Director.

2 Information regarding seed multiplication should be shared on proper seed multiplication proforma with correct required information in soft with both HoD and Director.

3 Co-PI/Team member in funded/core projects with well-defined scientific and technical responsibilities can be selected from within group with mutual consent, with approval of HoD within Division, and with the approval of director in other divisions of the institute. Co-PI/Team member experimental work should be reflected in the annual research program.

4 Services of Dr. Muhammad Amin, PS (Statistician) should be utilized for preparing field and laboratory experimental designs and data analyses.

5 Statistical analyses should be carried out for experimental data where applicable and in such case, only statistically significant results should be presented.

6 Research projects with potential for patentability, registration and marketability with defined timeline should be conceived.

7 If funded project is different from the core project, then two separate annual research programs should be submitted.

8 Each division should propose format for their division annual research program and in-house review.

9 RP & EC stressed and emphasized the need that all scientists should respond to instructions/directions received via emails from HoDs and Director NIFA.

10 Recommendations made by the RP & EC during in-house review, mid-year review and annual research program will be binding on respective scientists. Respective HoD will ensure its implementation.

PLANT BREEDING AND GENETICS DIVISION (PB&GD)

Annual Research Program (ARP) meeting of PB & GD was held on 20 September 2022 in NIFA conference room.

Horticulture group

Dr. Roshan Zamir, Head PB&GD presented results of his 2021-22 experiments, and shared 2022-23 research plan for 'evaluation of plum germplasm/mutants for yield/quality and other parameters. The RP & EC suggested that continuation of nursery raising should be submitted as a separate project provided that this had any real potential for income generation to NIFA. The activity of nursery raising should be reviewed with mutual consensus, keeping view its potential for income generation. In expected output section, statement like 'material generation for development of variety' should be written. Overall and specific objectives may be combined as one to avoid repetition.

Mr. Shahid A. Khalil, PS presented results of 2021-22 R&D work and talked about 2022-23 research plan for 'improvement of peaches for yield and quality. The RP & EC suggested him to deliver a detailed seminar on Biochar in NIFA fortnightly seminars series. He may follow in-house procedure for designating Dr. Syed Azam Shah, PS, S & ESD as Co-PI in his PSF-funded project. Biochar project should be submitted as a separate new project in addition to his core project. Stevia work may be dropped if not economical. Expected output section may thoroughly be reviewed.

Wheat irrigated group

Dr. Muhammad Irfaq Khan shared results of his 2021-22 research experiments and presented 2022-23 research plan for two projects on 'Evaluation of newly developed wheat genotypes in station and out-station trials for yield and yield related traits' and 'Genetic improvement of irrigated wheat through hybridization and induced mutation'. RP & EC suggested him to provide concrete data as there was no data mentioned for most of the findings. May report exact figures. May share complete data/information regarding seed multiplication in Buner with HoD and Director. He may include fresh (2021-22) data of candidate line in variety's proposal. Avoid writing his name in funded project (WPEP) as PI as no official communication is received from the donor. The RP & EC further noted that last variety developed and released by wheat irrigated group was in 2017 (NIFA Aman) which immediately became susceptible to yellow rust disease as it was clearly evident in 2018-19 and 2019-20 crop season at NIFA. The RP & EC was of the view that further propagation of this susceptible variety may be avoided/discouraged. Since release of the last variety, there was no addition to the list of new varieties from wheat irrigated group clearly showing decline of the group from last 4 to 5 years which mainly depends on efficiency of group leader.

Dr. Syed Tariq Shah presented his 2021-22 R&D work and shared his 2022-23 plan for 'evaluation of exotic wheat germplasm received from CIMMYT/CIB, CAS, China' and 'Breeding of okra for high yield through induced mutations/selection and breeding techniques'. The RP & EC advised him to mention name of the candidate line to be included in KPWYT in findings' section. Look for nutrients in available germplasm and/or acquire new ones for the said purpose. Try to publish an article from data related to quality traits of his wheat material. In case of okra, if disease resistance was one of the objectives, only prominent/common disease should be addressed. Adaptability trial of the selected lines/genotypes may be carried-out

Wheat rainfed group

Dr. Farooq-i-Azam presented results of 2021-22 research experiments and shared 2022-23 planned R&D work on 'Wheat improvement for rainfed areas of the Khyber Pakhtunkhwa'. The RP & EC suggested him that IAEA project should not be reported as on-going project in wheat rainfed group. Names of candidate line(s) should clearly be mentioned. Try to register variety in provinces where it performed well based on NUYT data particularly Gilgit Baltistan.

Dr. Salman Ahmad talked about results of 2021-22 experiments and presented 2022-23 R&D plan for 'Screening and evaluation of exotic/local wheat nurseries and trials under rainfed conditions' and 'Wheat breeding for disease resistance and moisture stress tolerance' and 'Quality wheat seed production'. The latter two projects were of Dr. Akhtar Ali, SS who on an official assignment outside NIFA on 20-09-2022. His work was presented by Dr. Salman Ahmad, SS. The RP & EC highly appreciated overall format of Dr. Akhtar Ali, SS and advised other scientists to follow. The RP & EC gave the overall suggestions including terminology 'selections' should be used instead of 'picking' in F_2/M_2 generation. In case of M_1, name of variety irradiated may clearly be mentioned. In case of evaluation of genotypes in nurseries, the nursery name and number of genotypes selected out of total genotypes may be mentioned. In case of moisture stress tolerance studies, performance regarding physiological parameters should be mentioned in out-come section. Attention may be given to get funded projects, and publish research articles in peer-reviewed journals

Oilseed Brassica group

Hafiz Munir Ahmad presented results of 2021-22 R&D work and discussed 2022-23 R&D plan for 'Genetic improvement of oilseed brassicas through induced mutations and hybridization techniques. RP & EC advised him that information regarding demonstration plots should be added in tabulated form. Other breeders were also advised to do the same. Objectives should be concise. Name of the variety to be submitted to Technical Committee of KP Seed Council should be mentioned and try to register variety NIFA Sarson T-20 in Punjab as recommended by Technical Evaluation Committee. Expected out-come should be brief and short. Correspondence regarding funded projects should be shared with both HoD and Director.

Mr. Khurshid Ahmad talked about results of experiments conducted in 2021-22 and shared 2022-23 R&D plan for 'Induction, manipulation of genetic variability and quality profiling of oilseed brassicas. Mr. Khushid Ahmad was advised by the RP & EC that expected out-come should be brief as it was lengthy. Genotypes having better oil contents coupled with significantly higher grain yield should be mentioned in findings' section. Findings should concise and not too lengthy. Attention may be paid to get funded projects

Pulses group

Dr. Iqbal Saeed talked about 2021-22 R&D work's results and shared his 2022-23 planned R&D activities on 'Breeding high yielding and large-seeded mungbean genotypes through induced mutation and cross breeding techniques' and 'Breeding heat tolerant and high yielding chickpea genotypes'. RP & EC advised him that he should pay attention to and follow specified format of ARP. Segregating material section should be concise and avoid lengthy paragraphs. Summary should be brief. Attention should be paid to submit new funded projects.

Mr. Shahzad Ahmad presented results of his research experiments in 2021-22 and shared information about planned research activities in 2022-23 R&D for 'Breeding high yielding common bean genotypes through induced mutation and cross breeding techniques'. The RP & EC advised him to pay attention to the document which should be brief and concise as it was too lengthy. The overall format should be reviewed. Attention may be paid to write and submit funded project in near future. Write and submit research article to peer-reviewed journal.

Dr. Muhammad Amin

Dr. Muhammad Amin shared his 2022-23 plan for 'Designing and statistical data analysis of field/lab research experiments'. RP & EC suggested him to share all statistical analysis done in 2022-23, next year in IHR and ARP. All ORIC activities may including number of students handled in a year may be mentioned. All statistical cooperation extended to NIFA's scientists should duly be recorded.

SOIL & ENVIRONMENTAL SCIENCES DIVISION

Annual Research Program (ARP) meeting of S&ESD was held on 21 September 2022 in NIFA conference room

Plant Nutrition Group

Dr. Muhammad Imtiaz, DCS/ Head, Soil & Environmental Sciences Division, described significance of project on bio-fortification of zinc (Zn) in wheat for balanced human nutrition. RP&EC suggested to incorporate genotypes for screening on Zn efficiency formally proposed by concerned breeder on official request through Head of Division.

Dr. Syed Azam Shah, PS described his project on integrated nutrient management of deciduous fruit orchards. He was proposed by RP&EC to provide a detailed report on month wise activities and include Horticulturist in ongoing project through a formal request if required. RP&EC suggested him to discontinue studies on plum as the material is consisted on mutants. The committee suggested him to initiate a new core project leading towards development of a marketable product (fertilizer) with timeline and also submit it to donor for funding. He was also suggested to share farmer's practice of nutrient management of small orchard in soft with HoD and Director. RP&EC found some technical errors in his experimental material and statistical design. He was suggested to provide sketch of peach plants under current study with year of flowering/fruiting initiation and nature of material (Name of varieties and mutants if any with dose/variety wise detail). He was further advised by the RP&EC to consult Dr. M. Amin, statistician and show his experimental design in field to him for improving error if any.

Mr. Mukhtiar Ali, PS discussed project on improving crop production technology of wheat and oilseed brassica. He was proposed to conduct fertilizer trial on brassica only if formally requested by concerned breeder. RP&EC suggested him to focus on core project aimed at studying impact of climate change on citrus production.

Mr. Parvez Khan, PS described project on improving off-season vegetables production under high tunnels through integrated nutrients and water management. His project was thoroughly discussed and valuable suggestions were made to improve contents

of project. RP&EC instructed to record feedback from beneficiaries of technology in the form of pictures and videos for future reference.

Soil Biology & Biochemistry Group

Dr. Amir Raza, PS/ Group Leader presented projects on organic farming, compost tea enrichment and water use efficiency studies. After deliberate discussions, RP&EC suggested to focus on product development for end-users. It was proposed to train Junior Scientist after identifying suitable training opportunities for strengthening capability of the group to develop a product.

Mr. Zahid Ali, PS and Mr. Shahzada Asif Ali, JS discussed projects on enrichment of compost for phosphorus and nitrogen contents, respectively. Participants were briefed that dedicated research efforts were made to identify suitable material for improving nutritive value of compost. Committee suggested to merge studies on enrichment of compost as one core project.

PLANT PROTECTION DIVISION (PPD)

Annual Research Program (ARP) meeting of PPD was held on 22 September 2022 in NIFA conference room.

Plant Pathology Group

Dr. Syed Jawad Ahmad Shah, DCS/Head PPD described his previous year's experiments achievements and presented details of his proposed project "Epidemiology of invasive and non-invasive pathogens of wheat, aphids, resistant genes/sources and chemical control" under ARP for the year 2022-23. His program was appreciated and was suggested to concise findings of his previous year research work and do not mention under review papers in ARP.

Biological Control Group

Mr. Muhammad Zahid, PS briefly discussed findings of his last year research studies and future work plan with reference to IAEA, CRP project on the application of Bio-control techniques coupled with SIT against tomato fruit borer. The committee advised him to either refrain from using the word high tunnel or transform the area into the same. He was further instructed to cover up the space with the specific cloth in order to transform it to high tunnel set up if necessary. In this regards, Mr. Muhammad Zahid responded that the high tunnel set up was made for experimental purpose, however, former Director instructed him to remove the cover cloth and he had done so. He further elaborated that the project activities are on the verge of completion and there would be no need of high tunnel set up. Mr. Zahid and all the scientists were instructed to include brief background of the projects and follow the given format of ARP. Ms. Noor Fatima, JS was on leave and Mr. Muhammad Zahid, PS described her achievements and presented her ARP project "improvement of egg parasitoid, *Trichogramma chilonis* (Ishii) culture on host eggs of Angoumois grain moth, *Sitotroga cerealella* (Oliv.)".

Mr. Usman Khalique, JS highlighted his work on use of bio-pesticides against *Helicoverpa armigera,* effect of various artificial and natural diets on the biology of fruit worm and screening results of wheat genotypes against aphids together with his future plans. The committee suggested him to include "wheat aphid" as separate project. The

committee suggested that the diet experiments should be conducted maximum for a year or two and after standardization of diet no further studies should be designed on it.

Medical Entomology Group

Dr. Gul Zamin Khan explained his previous year achievements and research plan under the project “integration of conventional and novel techniques for the development of environment friendly management strategies against dengue vectors” for the year 2022-23. Committee advised him to always mention names of the specific techniques he had used instead of writing only novel techniques. He was asked to mention current status of the projects he has submitted. Committee pointed out that the specific names of the non-target organisms should be mentioned in his study “Toxic effect of Parthenium on non-target organisms”. He was advised to reduce the number of experiments and confined only to those experiments that can lead him to product development or patent especially of bio-pesticide. He was also advised to address issues like availability of raw material for commercialization of parthenium based biopesticide product. He was advised to identify potential registration agencies and start his homework regarding registration requirements for biopesticide and traps in order to avoid hurdles and post product development complications. Dr. Gul Zamin was instructed to specify IAEA RAS project separately in his ARP and avoid to mention IAEA contract number in title.

Dr. Inamullah Khan, PS described details of his ARP-2022-23 and some outcome of his newly IAEA awarded project. The committee inquired, if the insect mentioned in the current project were on priority list of Govt. of Pakistan with reference to quarantine requirements. Dr. Inam briefed that few of the insects cited in the project are serious quarantine pests. Committee asked about the benefit of his project in general to Pakistan and in particular to NIFA. Dr. Inam told that the project will standardize radiation doses for phytosanitary treatments of agricultural commodities and project will develop techniques that could be used by quarantine department. Committee instructed Dr. Inam that outcome of the project should be specified, simplified and crisp and collaboration with quarantine department was emphasized for positive outcomes of the project. It was noted that ARP titles of both Dr. Gul Zamin Khan and Dr. Inamullah were more or less same and hence, both needed to prepare ARPs under separate titles. Dr. Gul Zamin was advised to focus on study with regard to parthenium and traps. It was also decided that instead of preparing separate projects, the PI would prepare one ARP indicating the relevant component to be done by the cooperating scientist. Dr. Inam also informed the house that his dengue guard patent write up is under progress.

Termite Control Group

Dr. Muhammad Misbah ul Haq, PS explained his on-going work achievements on the development of organic anti-termite product with insecticidal characteristics under the project “Exploitation of anti-termite potential of local plants for subterranean termite management in urban and agricultural setup”. He explained that his group found Garlic, Clove and turmeric as very effective anti-termite botanicals with high toxicity against subterranean termites. He was advised to identify potential registration agencies and start his homework regarding registration requirements in order to avoid hurdles and post product development complications.

Mr. Muhammad Irfan JS discussed his on-going work on the development of termite bait as marketable product under the project “development of local attractive bait matrix and toxin delivery foraging stations for control of subterranean termites’ species”. He was advised to identify method and points for application of bait in fields and buildings. He was also asked to set time frame for identification of foraging points and bait application. In response to queries, Mr. Irfan briefly highlighted the bait application method, number of baits to be used in a specific area, mode of action and its impact on termite population. He was asked to replace the word “bait station” with “foraging points” for more clarity in ARP. He was instructed by the committee to regularly share all information’s/status following PhD permission from PAEC HQ with both HoD and Director.

Fruit Fly Group

Dr. Muhammad Hamayoon Khan, SS briefly discussed his previous year’s findings and research planning for the next year with particular reference to the project “integrated Management of Fruit flies” with emphasis on the development of fruit fly attractant/ bait. He was advised by the committee to see feasibility of transforming his intended product into one which is more marketable. He was also advised to update himself regarding all aspects of registration/patenting required for fruit fly attractant/ bait.

Mr. Muhammad Salman, SS explained his previous year’s findings and details of forthcoming program under the project “Establishment of artificial rearing system to foster fruit fly IPM research”. He was advised to plan his future studies with the clear aim of developing a sale-able product. Mr. Salman was asked to direct his basic research experiments towards development of a patentable technology or product. He was asked to not include diet experiments formally in the ARP, though he may continue informally. He was advised to consult with Dr. Amin, PS regarding registration of improved/modified fruit fly trap. He was instructed by the committee to regularly share all information’s/status regarding PhD permission process both with HoD and Director.

FOOD AND NUTRITION DIVISION (FND)

Annual Research Program (ARP) meeting of FND was held on 23 September 2022 in NIFA conference room.

Food Engineering and Irradiation Group

Dr. Maazullah Khan, DCE/Group Leader/Head FND briefed about his previous year project entitled “Development of hybrid indirect type solar dryer for drying of fruits and vegetables”. RP&EC suggested him to include 3-4 sentences in the background and justification section and include a member from TSD for design and development of solar dryer.

Mr M. Zubair Shah, PE was on official assignment and his project entitled “Astringency removal and value addition of dates” was presented by head FND. He informed the house about the achievements of the previous year on the astringency removal from the Doka Dates of D.I. Khan. He further added that this year he will be conducted R&D activities on value addition of the mentioned Dates. The committee suggested that he may visit D.I Khan to see the local market of Dates, to identify actual problems of the farmers and submit a report up to 30 October, 2022. Head FND presented his second project on “Development of Bio-degradable food packaging for food and food

products" and highlighted the eco-friendly scope of the project. The ARP committee advised that Mr Zubair Shah will deliver a seminar to explore the viability of the project.

Mr Alamgeer Khan, SS presented his next year R&D on "Adaptation of Low Energy Machine Generated Radiation Sources" for Surface Decontamination and Disinfestation of Food in Pakistan. RP&EC suggested him to develop collaboration with the army units working on nuts processing in Waziristan agency as well as carry out a market survey for identification of real life problems associated with the nuts and include them in his ARP.

Mr M. Asim Irshad, JS was on leave and his ARP on "Mitigation of post-harvest losses and value addition of fruits and vegetables" was presented by Head FND. RP&EC suggested to engage Mr Asim in radiation work and development of food products.

Food & Environmental Safety Group

Dr. Muhammad Ibrahim, PS presented his ARP 2022-23 projects entitled "Pilot scale production of Ganoderma mushroom, popularization, cultivation optimization and crop diversification of edible mushroom as cottage industry" and "Bio-pesticide (Botanicals) formulation and application for the management of yellow rust in wheat". RP&EC suggested correction in the title of first project by removing 'Pilot scale production of Ganoderma mushroom' as well as highlight/increase R&D portion in the mushroom project. It was further instructed to explore the possibility to carry out R&D work on medicinal plants as herbal remedies.

Dr. Talat Mehmood, SS presented his planned R&D on the "Development & production of probiotic foods by using bio-preservation techniques". He informed the house that his ARP-2022-23 on bio preservation is part of the 5-year plan of PAEC and upcoming SPD project. Dr. Talat was suggested to utilize his research achievements to develop marketable products or to sell out the technology thus developed.

Mr. Muhammad Nisar, ARO presented his research project on quality and safety assessment of drinking water in local vicinity of Peshawar. RP&EC appreciated his work and suggested to replace "light metals" with Na, K, mg and Ca". It was also suggested to develop collaboration with the public health department for selection of water samples.

Food Nutrition Group

Dr. Zahid Mehmood, PS briefed the house about his R&D project on the development of an indigenous technology for the quantitative determination of Vitamin-A in oils/ fats. RP&EC suggested him to reduce background and justification to 3-4 sentences and provide details of budget in expenditure and requirements section.

Mr Ali Raza, SS presented his R&D work on the "Development of Nutritional Food Supplement (NFS) for Children". He highlighted the importance of indigence supplement that will increase export bill of the country. The committee suggest him that composition of the supplement may be identified and availability of the raw materials may be explored. Fate of the project will be decided up to 30th October and feasibility of the project will be evaluated in the seminar delivered by PI in the seminar series at NIFA.

Mr Tauqeer Ahmad, JS presented his research plan Development of Rapid Test Kit (RTK) for On-Spot Detection of fortified Zinc (Zn) in Fortified Wheat Flour (FWF). RP&EC suggested him to rephrase the specific objectives.

Research Planning & Evaluation Committee (RP&EC) Signatures

Dr. Muhammad Imtiaz, DCS, Head SE &SD

Dr. S. Jawed Ahmad Shah, DCS, Head PPD
(Convener)

Dr. Maazullah Khan, DCE, Head FND

Dr. Roshan Zamir, DCS, Head PB & GD

15/11/22

(Dr. Gul Sanat Shah)
Director NIFA