A TECHNICAL REPORT ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME

(SIWES)

HELD AT

NIGERIAN STORED PRODUCTS RESEARCH INSTITUTE

ASA-DAM ROAD, ILORIN, KWARA STATE

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DEDICATION

This report is dedicated to Almighty Allah who is the beginning and the end of my existence, the reason I breathe, but for his grace and mercies I would not be writing this report this day. Also to my lovely and wonderful parents Mr. and Mrs. Olasile for your labor of love and support through these years, to my brothers, sisters and friends a big thank you for your support.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Allah for his grace throughout my industrial training and to members of Nigerian Stored Products Research Institute (NSPRI) as well as my industry-based supervisor for their kind cooperation and encouragement which helped me in completion of this SIWES. Special gratitude to the Olasile family for their support in my educational pursuit.

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CHAPTER ONE

1.1 INTRODUCTION

The Students Industrial Work Experience Scheme (SIWES) is a skill acquisition program established to expose students in tertiary institutions to practical knowledge in their respective fields of study. It is designed to bridge the gap between theoretical classroom learning and real-life industrial applications. The program is mandatory for students in science, engineering, agriculture, and other applied fields to equip them with the necessary hands-on experience before graduation.

The Nigerian Stored Products Research Institute (NSPRI) is a leading research institute in Nigeria focused on the storage, preservation, and protection of agricultural produce. It plays a crucial role in ensuring food security by developing effective storage technologies that help reduce post-harvest losses, maintain quality, and prolong the shelf life of stored products. Agricultural storage is a significant aspect of food production, as poor storage conditions can lead to spoilage, contamination, and significant economic losses.

The efficiency of agricultural produce storage structures is influenced by internal and external environmental factors such as temperature, humidity, ventilation, and pest infestation. Properly designed storage structures help to regulate these factors, ensuring that stored products remain in good condition for extended periods. The internal environment of storage facilities includes controlled conditions that affect produce quality, while the external environment involves climatic and environmental factors that can impact storage effectiveness.

This study focuses on the importance of proper storage structures and environmental conditions in the preservation of agricultural produce. Through my SIWES training at NSPRI, I was able to gain practical knowledge about storage systems, environmental control measures, and

the challenges associated with agricultural produce storage. This experience provided valuable insights into modern storage techniques aimed at minimizing losses and ensuring food security.

1.2 BRIEF ABOUT NSPRI

Nigerian Stored Products Research Institute (NSPRI) was established in 1948 as West African Stored Products Research Unit (WASPRU) to assess the quality of exportable crops from Nigeria, Ghana, Sierra Leone, and Gambia to United Kingdom during the colonial era. It became Nigerian Stored Products Research Institute after the independence in 1960.

The mandate of the Institute stipulates that it shall carry out research into bulk storage problems of export commodities and local food crops. In particular, it shall conduct research into: improvement and maintenance of the quality of bulk commodity crops including cocoa, groundnuts, and palm produce; improvement and maintenance of the quality of local food crops including cereals, grains, pulses, tubers and any other local commodity under bulk storage; special studies such as stored products pests, pesticide formulations and residue and mycotoxin surveys; provision of advice and training of extension workers in problems associated with stored products and materials in storage structures, new insecticides, new items of equipment and techniques; and any other related matters as may be determined from time to time by the Institute.

NSPRI is one of the Research Institutes under the supervision of Agricultural Research Council of Nigeria (ARCN) in the Federal Ministry of Agriculture and Natural Resources. The Institute's headquarters is in Ilorin, Kwara State and zonal offices in Ibadan, Kano, Lagos, and Port-Harcourt, as well as outstations in Sapele and Maiduguri.

1.3 OBJECTIVES OF THE SIWES TRAINING

The Students Industrial Work Experience Scheme (SIWES) at the Nigerian Stored Products Research Institute (NSPRI) was designed to provide hands-on experience in agricultural produce storage and preservation. The specific objectives of the training include:

1. **To gain practical knowledge of agricultural produce storage –** Understanding the various storage structures used in preserving agricultural products and how they function.
2. **To study the internal and external environments of storage facilities** – Learning about factors such as temperature, humidity, ventilation, and their impact on stored products.
3. **To understand post-harvest storage techniques** – Exploring different methods used to reduce post-harvest losses and improve food security.

4. **To acquire skills in the monitoring and maintenance of storage structures** – Participating in routine checks, cleaning, and pest control measures to ensure optimal storage conditions.
5. **To learn about pest and disease management in stored products** – Identifying common pests and diseases that affect stored agricultural produce and the preventive measures used to control them.
6. **To develop problem-solving and technical skills in agricultural storage** – Gaining experience in troubleshooting storage-related issues and applying scientific methods to improve storage conditions.
7. **To bridge the gap between theoretical knowledge and practical application** – Applying classroom knowledge in a real-world setting to enhance understanding and competence in agricultural storage management.
8. **To engage in routine farm activities such as feeding of layers** – Participating in additional agricultural tasks to gain broader experience in farm management.

These objectives were achieved through hands-on training, supervision, and active participation in daily storage and maintenance activities at NSPRI.

1.4 SIGNIFICANCE OF THE SIWES

The Students Industrial Work Experience Scheme (SIWES) is a vital component of academic training, providing students with practical exposure to real-world applications in their fields of study. This study, conducted at the Nigerian Stored Products Research Institute (NSPRI), is significant in several ways, particularly in the area of agricultural produce storage and preservation.

1. **Bridging the Gap Between Theory and Practice** – The training provided hands-on experience, enabling the application of theoretical knowledge gained in the classroom to real-life situations in agricultural storage and preservation.
2. **Enhancing Skills in Agricultural Storage Management** – The study deepened understanding of various storage structures (e.g., silos, warehouses, cribs) and environmental factors (temperature, humidity, ventilation) that affect stored products.
3. **Contributing to Food Security** – By learning efficient post-harvest storage techniques, students gain insights into how to reduce food spoilage and wastage, which is crucial in ensuring food security and economic stability.
4. **Developing Problem-Solving and Technical Skills** – Exposure to real challenges in agricultural storage, such as pest infestation, mold growth, and improper ventilation, helped develop critical thinking and problem-solving skills for addressing these issues.
5. **Understanding the Role of Environmental Factors** – The study highlighted the importance of both internal and external environments in maintaining product quality, which is essential for agricultural sustainability.
6. **Building Career Readiness** – The training prepared students for future careers in agriculture, food storage, and post-harvest management by providing industry experience and fostering professional skills.
7. **Supporting National Agricultural Development** – The knowledge gained from the training contributes to Nigeria's efforts in improving agricultural storage systems, reducing post-harvest losses, and enhancing overall productivity.

Through this study, I gained valuable expertise in agricultural storage and post-harvest management, which will be beneficial in both academic and professional settings.

1.5 SCOPE OF THE TRAINING

The Students Industrial Work Experience Scheme (SIWES) at the Nigerian Stored Products Research Institute (NSPRI) covered various aspects of agricultural produce storage and preservation. The training provided practical exposure to different storage systems, environmental factors, and management techniques. The scope of the training includes the following key areas:

1. **Agricultural Produce Storage Structures** – Understanding the design, construction, and function of various storage structures, including:
    - Silos
    - Warehouses
    - Cribs
    - Cold storage facilities
2. **Internal and External Environmental Conditions** – Studying the factors that affect the quality of stored products, such as:
    - Temperature and humidity control
    - Ventilation systems
    - Effects of external weather conditions on storage efficiency
3. **Post-Harvest Storage Techniques** – Learning about modern and traditional methods used to preserve and extend the shelf life of stored agricultural products.
4. **Pest and Disease Control in Stored Products** – Understanding common storage pests (e.g., insects, rodents, fungi) and learning methods of pest prevention and control, such as:
    - Chemical fumigation
    - Biological control methods
    - Hygiene and sanitation practices

5. **Routine Monitoring and Maintenance of Storage Facilities** – Engaging in activities like:

   Checking temperature and humidity levels

   - Inspecting for pest infestations
   - Cleaning and maintaining storage structures

6. **Practical Involvement in Farm Activities** – Apart from storage-related activities, participation in additional tasks such as the routine feeding of layers to gain broader experience in agricultural management.

The training was comprehensive in providing hands-on experience in storage facility management, environmental monitoring, and post-harvest loss prevention. However, due to time constraints, some aspects of advanced storage technology and research could not be fully explored.

1.6 LIMITATIONS OF THE SIWES

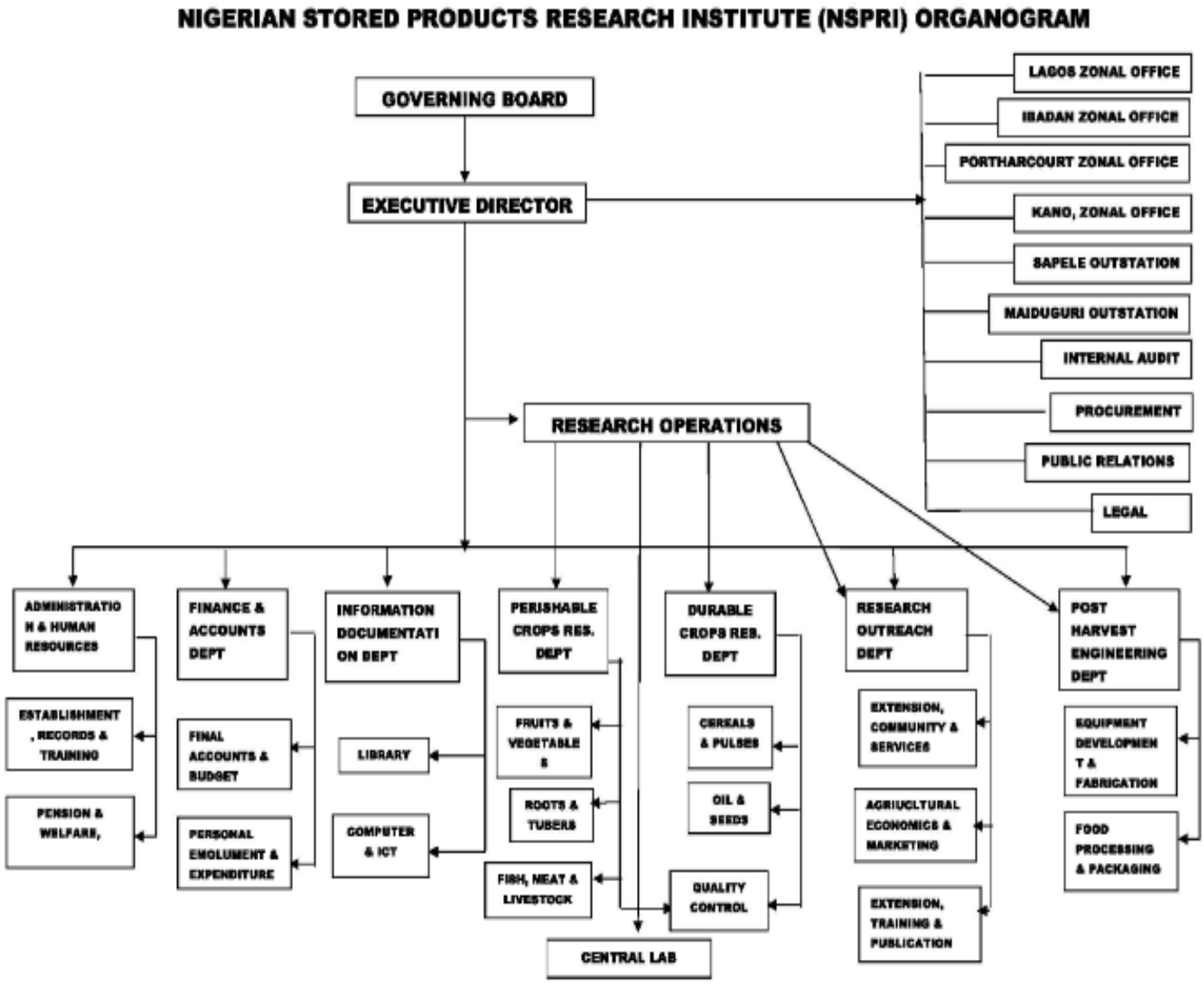
Despite the valuable knowledge and hands-on experience gained during the Students Industrial Work Experience Scheme (SIWES) at the Nigerian Stored Products Research Institute (NSPRI), some challenges and limitations were encountered. These limitations include:

1. **Time Constraints** – The duration of the training was relatively short, limiting the opportunity to explore all aspects of agricultural produce storage and preservation in detail.
2. **Limited Exposure to Advanced Storage Technologies** – While the training covered fundamental storage techniques, access to more modern storage technologies (e.g., automated climate control systems, advanced preservation methods) was restricted.
3. **Environmental and Weather Challenges** – External environmental factors, such as changes in weather conditions, affected some practical activities related to storage facility management.

4. **Limited Practical Involvement in Some Research Activities** – Due to the specialized nature of some research projects at NSPRI, full participation in certain studies and laboratory experiments was not always possible.
5. **Resource Limitations** – Some equipment and materials required for an in-depth study of storage environments and pest control methods were either limited or unavailable.
6. **Limited Hands-on Training in Pest Control Techniques –** While theoretical knowledge of pest and disease control was gained, direct involvement in advanced fumigation and biological control measures was minimal.
7. **Technical and Logistical Challenges** – Occasional equipment malfunctions and power outages affected certain practical sessions, impacting data collection and analysis.

Despite these limitations, the training provided valuable insights into agricultural storage systems and helped bridge the gap between theoretical knowledge and real-world applications.

1.7 ORGANIZATION CHART



CHAPTER TWO

2.1 AGRICULTURAL PRODUCE STORAGE AND ITS IMPORTANCE

Agricultural produce storage refers to the process of keeping harvested crops and livestock products in suitable conditions to maintain their quality and extend their shelf life. Storage plays a significant role in:

- Preventing post-harvest losses caused by pests, spoilage, and unfavorable environmental conditions.
- Maintaining food quality and safety for human consumption.
- Ensuring food security by providing a steady supply of agricultural products throughout the year.
- Reducing economic losses for farmers and food producers.

2.2 TYPES OF AGRICULTURAL PRODUCE STORAGE STRUCTURES

Different storage structures are used based on the type of agricultural product, environmental conditions, and storage duration. Some common storage structures include:

1. Traditional Storage Structures

Barns and Granaries – Commonly used for grains, these structures are built with materials like wood, mud, and thatch.

Cribs – Mainly used for drying and storing maize, allowing proper aeration to prevent mold growth.

2. Modern Storage Structures

Silos – Large cylindrical structures used for storing bulk grains; they provide controlled environmental conditions to prevent spoilage.

Warehouses – Large storage buildings used for processed agricultural products, equipped with ventilation and temperature control.

Cold Storage Facilities – Refrigerated storage units used for perishable goods such as fruits, vegetables, and dairy products.

2.3 INTERNAL AND EXTERNAL STORAGE ENVIRONMENTS

The efficiency of storage structures depends on both internal and external environmental factors, which influence the quality and longevity of stored agricultural produce.

1. Internal Environmental Factors

Temperature – Maintaining an optimal temperature prevents spoilage and microbial growth.

Humidity – High humidity promotes mold growth and spoilage, while low humidity can cause excessive drying of stored products.

Ventilation – Proper airflow helps regulate temperature and humidity levels.

Pest and Microbial Control – Preventing insect infestation, rodents, and microbial contamination is crucial in maintaining storage quality.

2. External Environmental Factors

Climatic Conditions – High temperatures and excessive rainfall can negatively impact storage efficiency.

Structural Integrity – The durability of storage buildings against harsh weather conditions and pest infiltration.

Proximity to Farms and Markets – Distance to farms and markets affects the ease of transportation and storage efficiency.

2.4 PEST AND DISEASE CONTROL IN STORED AGRICULTURAL PRODUCTS

One of the biggest challenges in agricultural storage is pest infestation and microbial contamination. Common pests affecting stored products include:

Insects (weevils, beetles, moths) – Cause physical damage to grains, leading to spoilage.

Rodents (rats, mice) – Consume and contaminate stored food with droppings.

Fungi and Bacteria – Lead to food spoilage and production of harmful toxins like aflatoxins.

Pest and Disease Control Measures

To prevent losses, several pest and disease control methods are used:

Chemical Methods – Use of fumigants, insecticides, and rodenticides.

Biological Control – Introduction of natural predators to control pest populations.

Physical Methods – Proper ventilation, drying, and use of airtight containers.

Hygienic Practices – Regular cleaning of storage facilities to prevent pest breeding.

2.5 POST-HARVEST STORAGE TECHNIQUES

Different preservation techniques are used depending on the type of agricultural product. Common post-harvest storage methods include:

Drying – Reducing moisture content in grains to prevent mold growth.

Cold Storage – Refrigeration of perishable goods to slow down spoilage.

Controlled Atmosphere Storage – Regulating oxygen and carbon dioxide levels to extend shelf life.

Use of Preservatives – Chemical treatments to prevent microbial spoilage.

CHAPTER THREE

The Students Industrial Work Experience Scheme (SIWES) at the Nigerian Stored Products Research Institute (NSPRI). The study of agricultural produce storage structures, internal and external environments, and post-harvest preservation techniques. It also describes the various tasks performed, the equipment used, and the learning process involved.

3.1 METHOD OF THE TRAINING

1. **Observation and Supervision** – Trainees observed and learned from experienced professionals working in agricultural storage and preservation.
2. **Hands-on Practical Experience** – Active participation in the management, maintenance, and monitoring of storage structures.
3. **Guided Experiments and Tests** – Conducting environmental monitoring, pest control, and storage condition assessments.
4. **Routine Activities** – Engaging in daily activities such as data recording, facility inspections, and participation in other farm-related tasks.

3.2 TRAINING ACTIVITIES

The training covered several key areas related to agricultural storage and environmental management. The major activities carried out during the SIWES training include:

3.2.1 Study of Agricultural Produce Storage Structures

- Observation of different storage structures such as silos, warehouses, cribs, and cold storage facilities.
- Understanding the design and function of storage buildings to maintain optimal environmental conditions.

- Assessment of structural integrity to identify potential risks such as leakage, poor ventilation, or pest entry points.

3.2.2 Monitoring Internal and External Storage Environments

- Measuring temperature and humidity levels in different storage facilities using digital sensors.
- Evaluating ventilation systems to ensure proper air circulation.
- Recording data on climatic conditions (external environment) and their effects on stored products.

3.2.3 Post-Harvest Preservation Techniques

- Examining different drying methods to reduce moisture content in stored grains.
- Understanding cold storage techniques for perishable items.
- Observing chemical treatments used for pest control and microbial prevention.

3.2.4 Pest and Disease Control Measures

- Identification of common storage pests such as weevils, beetles, and rodents.
- Application of pest control techniques including fumigation, biological control, and sanitation practices.
- Inspection of stored products for signs of infestation and spoilage.

3.2.5 Routine Maintenance of Storage Facilities

- Cleaning and sanitization of warehouses and silos to prevent contamination.
- Repair and maintenance of storage equipment and ventilation systems.
- Ensuring proper packaging and stacking of stored products to minimize damage.

3.2.6 Participation in Farm Activities

- Routine feeding of layers, observing poultry management practices.
- Learning about feed formulation and nutrition management.
- Monitoring poultry health and maintaining hygiene in the poultry environment.

3.3 EQUIPMENT AND TOOLS USED

During the training, various equipment and tools were utilized, including:

Thermometers and Hygrometers – For measuring temperature and humidity levels in storage facilities.

Moisture Meters – For determining the moisture content of grains.

Ventilation Systems – To regulate airflow in storage structures.

Fumigation Equipment – For pest control applications.

Protective Gear – Such as gloves and face masks for safety during fumigation and cleaning activities.

CHAPTER FOUR

OBSERVATIONS, FINDINGS, AND CHALLENGES

4.1 OBSERVATIONS DURING THE TRAINING

Several important observations were made throughout the training, particularly in the areas of storage structures, environmental conditions, and produce management:

4.1.1 Agricultural Produce Storage Structures

- Storage structures at NSPRI vary based on the type of agricultural product stored, with silos, warehouses, cribs, and cold storage units being the most commonly used.
- Well-maintained storage structures help prevent spoilage and post-harvest losses.
- Proper design, including ventilation systems and moisture control measures, significantly affects the efficiency of storage.

4.1.2 Internal and External Environmental Conditions

- Temperature and humidity levels are crucial in preventing deterioration of stored produce.
- External climatic conditions influence the effectiveness of storage structures.
- Poor ventilation can lead to heat buildup and moisture accumulation, increasing the risk of spoilage.

4.1.3 Post-Harvest Storage and Preservation Techniques

- Drying, refrigeration, and chemical treatments are common methods used to prolong the shelf life of stored products.
- Proper drying of grains before storage reduces the risk of mold growth and mycotoxin contamination.
- Cold storage units effectively preserve perishable products but require constant electricity supply.

4.1.4 Pest and Disease Control in Storage

- Insects such as weevils, beetles, and moths are common pests in stored grains.
- Rodents (rats and mice) pose a significant threat to stored produce by consuming and contaminating food supplies.
- Chemical fumigation is a widely used pest control method, but it requires proper handling to avoid health risks.
- Regular cleaning and hygiene practices reduce pest infestations.

4.1.5 Routine Maintenance of Storage Facilities

- Regular inspection of storage units helps detect early signs of spoilage, pest infestations, and structural damage.
- Proper arrangement of stored products enhances ventilation and minimizes contamination risks.
- Effective maintenance practices increase the lifespan of storage structures and ensure efficient performance.

4.2 FINDINGS FROM THE TRAINING

Based on the observations, several key findings emerged:

- Proper storage structure selection is crucial in minimizing post-harvest losses.
- Environmental factors such as temperature, humidity, and ventilation play a major role in determining the storage lifespan of agricultural produce.
- Pest control is an essential aspect of storage management, requiring a combination of chemical, biological, and physical control measures.
- Training on storage facility management is necessary for individuals involved in post-harvest agricultural practices.

- Energy supply issues affect the effectiveness of cold storage facilities, leading to challenges in preserving perishable goods.
- Routine monitoring and maintenance of storage structures significantly reduce the risk of spoilage and contamination.

CHAPTER FIVE

5.1 SUMMARY OF TRAINING EXPERIENCE

The SIWES training at NSPRI provided hands-on knowledge and skills in the following key areas:

i. Understanding different agricultural storage structures such as silos, warehouses, cribs, and cold storage units.

ii. Monitoring internal and external storage environments, including temperature, humidity, and ventilation control.

iii. Applying post-harvest preservation techniques such as drying, refrigeration, and chemical treatments.

iv. Pest and disease control in storage, including fumigation, biological control, and hygiene practices.

v. Routine maintenance of storage facilities to prevent spoilage and contamination.

vi. Participation in additional farm activities, such as the routine feeding of layers and general farm management.

5.2 CONCLUSION

The SIWES training at NSPRI was a rewarding and educational experience, providing valuable insights into agricultural storage structures, environmental monitoring, pest control, and post-harvest preservation techniques. While some challenges were encountered, the overall experience was beneficial in preparing for real-world applications in agricultural storage and food security. The recommendations provided, if implemented, will help improve storage practices, minimize post-harvest losses, and enhance future SIWES programs for students.

The SIWES training was a valuable experience that helped bridge the gap between theoretical knowledge and practical applications in agricultural storage and preservation. The following conclusions can be drawn from the training:

i. Proper storage structures and environmental control are essential in minimizing post-harvest losses and maintaining product quality.
ii. Pest and disease management strategies must be effectively implemented to prevent contamination and spoilage.
iii. Cold storage facilities require a stable power supply for effective preservation of perishable products.
iv. Routine monitoring and maintenance are necessary for optimizing storage efficiency and reducing waste.
v. The training enhanced technical skills and practical knowledge, preparing students for real-world challenges in agricultural storage and management.

5.3 RECOMMENDATIONS

Based on the experiences and findings from the training, the following recommendations are made:

5.3.1 Recommendations for Agricultural Storage Practices

1. Improve Storage Infrastructure – Adoption of modern storage technologies such as automated climate control systems will enhance storage efficiency.
2. Enhance Pest Control Measures – Integrated pest management (IPM) should be encouraged to reduce reliance on chemical fumigation.
3. Increase Awareness of Post-Harvest Handling – Farmers and storage managers should be educated on best practices for storage, preservation, and pest control.

4. Ensure Stable Power Supply for Cold Storage – Alternative energy sources, such as solar-powered cold storage units, should be explored.
5. Regular Maintenance of Storage Facilities – Scheduled inspections and cleaning should be carried out to prevent structural damage and product contamination.

5.3.2 Recommendations for Future SIWES Training

1. Extend Training Duration – A longer training period will allow for deeper exploration of advanced storage techniques.
2. Increase Access to Modern Equipment – Institutions should provide students with exposure to state-of-the-art agricultural storage technologies.
3. Encourage More Practical Involvement – Hands-on experience in areas such as fumigation and advanced storage monitoring systems should be prioritized.
4. Improve Coordination Between Institutions and Industries – Stronger partnerships between universities and research institutes like NSPRI will enhance learning opportunities.
5. Provide Safety Training for Handling Chemicals – Since fumigation and pest control involve toxic substances, safety protocols and protective measures should be emphasized.

5.4 CONTRIBUTION OF THE TRAINING TO CAREER DEVELOPMENT

The SIWES training greatly contributed to career development by:

1. Providing practical skills in agricultural storage management.
2. Enhancing problem-solving abilities through hands-on experience with storage challenges.
3. Expanding knowledge in post-harvest loss prevention and environmental control.
4. Improving teamwork and communication skills by working alongside professionals in the field.