ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

Collection, Biochemical Characterization and Field Evaluation of Pigeonpea (Cajanus cajan (L.) Millsp.) Germplasm from the 2nd District of Ilocos Sur Under Organic Farming Conditions in Cervantes, Ilocos Sur

Nida I. Gaqui

A Master's Thesis Presented to the Faculty of the ILOCOS Sur Polytechnic State College Philippines
In Partial Fulfillment of the Requirements to the Degree Master of Science in Agriculture
Major in Agronomy

Publication Date: 2026/11/25

Abstract: This proposed study will collect, characterize, and evaluate pigeonpea (Cajanus cajan (L.) Millsp.) germplasm from selected municipalities of the 2nd District of Ilocos Sur under organic farming conditions in Cervantes, Ilocos Sur. It aims to document locally available accessions, determine the initial biochemical composition of collected seeds, assess their agronomic characteristics and yield performance, and compare the biochemical composition of the original seed samples with that of the seeds harvested after field evaluation. Germplasm will be collected from farmers, backyard growers, and community seed sources. Each accession will be assigned a unique code, and relevant information on its source and collection location will be recorded. Representative seed samples will undergo initial laboratory analysis for moisture, crude protein, crude fat, crude fiber, ash, and carbohydrates, subject to laboratory capability. The field experiment will be established in Cervantes, Ilocos Sur, using a Randomized Complete Block Design (RCBD) with three replications, where each accession will serve as a treatment. The accessions will be grown using uniform organic crop management practices. Data will be gathered on plant height, number of branches, days to 50% flowering, days to maturity, pods per plant, seeds per pod, 100-seed weight, seed yield per plant, and seed yield per plot. After harvest, representative seed samples will be submitted for biochemical analysis using the same parameters and analytical procedures applied to the initial samples. Agronomic and yield data will be analyzed using analysis of variance appropriate for RCBD, while biochemical results will be compared descriptively and statistically when the sampling structure provides suitable independent replication. The study is expected to generate baseline information on the identity, agronomic performance, yield potential, and seed composition of locally collected pigeonpea accessions. The findings may support the conservation and future utilization of pigeonpea genetic resources and help identify accessions worthy of further evaluation for organic and upland production systems.

Keywords: *Pigeonpea, Germplasm Collection, Biochemical Composition, Agronomic Evaluation, Organic Farming.*

How to Cite: Nida I. Gaqui (2026) Collection, Biochemical Characterization and Field Evaluation of Pigeonpea (Cajanus cajan (L.) Millsp.) Germplasm from the 2nd District of Ilocos Sur Under Organic Farming Conditions in Cervantes, Ilocos Sur. *International Journal of Innovative Science and Research Technology*, 11(11), 1533-1543. https://doi.org/10.38124/ijisrt/26nov690

I. INTRODUCTION

➢ *Background of the Study*

Pigeonpea (Cajanus cajan (L.) Millsp.) is an important grain legume cultivated in tropical and subtropical regions. It is valued for its edible seeds, nutritional contribution, adaptability to relatively dry environments, and multiple uses in farming systems. The crop can be used for human food, animal feed, green manure, and other farm purposes. Its ability to form symbiotic associations with nitrogen-fixing microorganisms also makes it relevant to sustainable agricultural systems and soil nutrient cycling (Nene & Sheila, 1990; Rao et al., 2002).

Pigeonpea is recognized for its tolerance to drought and its capacity to grow under rainfed and marginal production conditions. Its deep root system can help the plant access moisture from deeper soil layers, making it a potential crop for upland areas where water availability may be limited (Upadhyaya et al., 2011). These characteristics

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

are relevant to farming communities that experience variable rainfall and rely on relatively low-input production practices.

Aside from its agronomic value, pigeonpea seeds contain important nutritional components, particularly protein, carbohydrates, dietary fiber, lipids, and minerals. However, the nutritional composition of seeds may vary among accessions and may be influenced by genetic characteristics, growing environment, crop management, and seed maturity. Assessing the biochemical or proximate composition of collected seed materials before planting and again after harvest can provide information on the composition of the original planting materials and the seeds produced under the field conditions of the study.

In the Philippines, pigeonpea has been evaluated under local conditions. Bernabe (2019) reported the evaluation of eight pigeonpea genotypes in the Ilocos Region, with attention to yield, disease resistance, farmer acceptability, and adaptation. This indicates the potential of pigeonpea germplasm for further evaluation and utilization in the region.

Despite this potential, the availability and characteristics of farmer-maintained pigeonpea germplasm in the 2nd District of Ilocos Sur remain insufficiently documented. Collecting planting materials from different municipalities can help document locally maintained accessions and conserve potentially useful genetic resources. Recording the collection site, local name, source, and farmer practices will also provide basic information about each accession.

Field evaluation is necessary to determine how the collected accessions perform under a common set of organic field conditions. Agronomic characteristics such as plant height, number of branches, flowering, and maturity, together with yield components such as pods per plant, seeds per pod, seed weight, and seed yield, can be used to describe differences among accessions. Comparing the initial and post-harvest biochemical composition of seeds using the same laboratory parameters can further indicate whether measurable differences occur between the collected seed samples and the seeds produced after field cultivation.

Therefore, this study will collect pigeonpea germplasm from the 2nd District of Ilocos Sur, determine the initial biochemical composition of the collected seeds, evaluate their agronomic performance and yield components under organic farming conditions in Cervantes, Ilocos Sur, and conduct post-harvest biochemical analysis. The results may provide baseline information for the conservation, evaluation, and possible utilization of pigeonpea germplasm in the locality.

➢ *Objectives of the Study*

- *General Objective*

To collect, characterize, and evaluate pigeonpea germplasm from the 2nd District of Ilocos Sur through initial and post-harvest biochemical analysis and field evaluation under organic farming conditions in Cervantes, Ilocos Sur.

- *Specific Objectives*

✓ To collect and document pigeonpea germplasm accessions from selected municipalities of the 2nd District of Ilocos Sur;
✓ To determine the initial biochemical composition of the collected seed accessions before planting;
✓ To evaluate the agronomic characteristics and growth performance of the collected accessions under organic field conditions;
✓ To determine the yield components and seed yield of each accession;
✓ To determine the biochemical composition of the harvested seeds using the same laboratory parameters applied to the initial seed samples; and
✓ To compare the initial and post-harvest biochemical composition of the accessions and determine whether measurable differences occur.

➢ *Hypothesis of the Study*

The study will test the following null hypothesis:

- H_0: There is no significant difference between the initial and post-harvest biochemical composition of pigeonpea seed accessions evaluated in the study.
- H_{02}: There are no significant differences among the collected pigeonpea accessions in their agronomic characteristics, yield components, and seed yield under the field conditions of the study.

➢ *Significance of the Study*

- Farmers. The findings may provide information on locally available pigeonpea accessions and their field performance, which can support future decisions on planting material selection.
- Researchers and students. The study may provide baseline information on the agronomic and biochemical characteristics of pigeonpea germplasm collected from the 2nd District of Ilocos Sur.
- Local Government Units. The results may support local initiatives on crop diversification, conservation of plant genetic resources, and sustainable upland agriculture.
- Agricultural extension workers. The findings may serve as a reference when discussing pigeonpea production, seed characteristics, and potential accessions for further evaluation.
- Consumers and communities. The biochemical analysis may provide information on the proximate composition of the seeds produced from the evaluated accessions.

➢ *Scope and Delimitation of the Study*

The study will focus on pigeonpea germplasm collected from selected municipalities of the 2nd District of Ilocos Sur. The collected seed accessions will undergo initial biochemical analysis before planting and will

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

subsequently be evaluated in a field experiment in Cervantes, Ilocos Sur, under organic farming conditions. Agronomic characteristics, yield components, and seed yield will be recorded. After harvest, seed samples from the accessions will undergo biochemical analysis using the same parameters and laboratory procedures applied to the initial samples.

The study will be limited to the accessions successfully collected and established during the conduct of the experiment. The number of accessions will depend on the availability of planting materials. DNA marker analysis is not included in the revised scope. The biochemical parameters and analytical procedures will be finalized in consultation with the laboratory that will conduct the tests and will depend on laboratory capacity, available methods, and research budget.

➢ *Time and Place of the Study*

Germplasm collection will be conducted in selected municipalities within the 2nd District of Ilocos Sur where pigeonpea is grown or maintained by farmers. Field evaluation and crop production activities will be conducted in Cervantes, Ilocos Sur, under organic farming conditions. Initial and post-harvest biochemical analyses will be conducted at an appropriate laboratory with the capability to perform the selected proximate or biochemical tests. The study is proposed to be conducted from April to December 2027.

➢ *Definition of Terms*

- Accessions – Distinct seed samples collected from different farmers or locations and assigned individual identification numbers for evaluation.
- Agronomic characteristics – Observable plant growth and development traits measured during the field evaluation, such as plant height, branching, flowering, and maturity.
- Biochemical composition – The measurable chemical or nutritional components of pigeonpea seeds assessed through laboratory analysis.
- Germplasm – Plant genetic resources, including seeds or other plant materials, collected and maintained for conservation, evaluation, and utilization.
- Pigeonpea – Cajanus cajan (L.) Millsp., a grain legume valued for its edible seeds and adaptation to tropical and subtropical environments.
- Proximate analysis – Laboratory determination of basic food components, commonly including moisture, crude protein, crude fat, crude fiber, and ash; carbohydrate may be estimated by difference.
- Yield components – Plant and seed characteristics contributing to crop yield, including pods per plant, seeds per pod, and 100-seed weight.
- Post-harvest seed sample – Seed material collected after the pigeonpea crop has reached harvest maturity and has been harvested, cleaned, and prepared for laboratory analysis.

II. REVIEW OF RELATED LITERATURE

➢ *Pigeonpea as a Food Legume Crop*

Pigeonpea (Cajanus cajan (L.) Millsp.) is an important grain legume cultivated in tropical and subtropical regions. It is valued for its nutritional content, adaptability to different environmental conditions, and multiple agricultural uses. The seeds are commonly consumed as a source of plant-based protein and carbohydrates, while other plant parts can be utilized as animal feed, green manure, and fuelwood. Its ability to establish symbiotic relationships with nitrogen-fixing microorganisms also contributes to soil fertility and sustainable agricultural production (Nene & Sheila, 1990; Rao et al., 2002).

Pigeonpea is particularly important in rainfed and upland agricultural systems because of its relatively deep root system and ability to tolerate periods of limited water availability. These characteristics allow the crop to access moisture from deeper soil layers and survive under conditions where other crops may experience water stress. Its adaptability makes it a potential alternative crop for farming communities that experience variable rainfall and have limited access to irrigation facilities (Upadhyaya et al., 2011).

Aside from its agricultural importance, pigeonpea contributes to food and nutritional security. Its seeds contain protein, carbohydrates, dietary fiber, fats, and minerals. These nutritional components make it a valuable food crop, particularly in communities where affordable sources of plant-based protein are important. The crop also offers opportunities for crop diversification and the utilization of marginal agricultural areas.

➢ *Importance of Germplasm Collection and Conservation*

Germplasm collection is an important activity in the conservation, characterization, and utilization of plant genetic resources. It involves collecting seeds or other planting materials from different geographical locations to preserve genetic diversity and provide materials for future agricultural research and crop improvement. Local farmers are important sources of germplasm because they often maintain traditional varieties that may possess useful characteristics developed through years of cultivation and selection (FAO, 2010).

The collection of pigeonpea germplasm from different municipalities of the 2nd District of Ilocos Sur will provide an opportunity to identify and document locally available planting materials. Each collected accession may differ in seed characteristics, plant architecture, maturity period, growth performance, and yield potential. Proper documentation of the origin, local name, collection location, and farmer production practices is necessary to maintain the identity and traceability of each accession.

The importance of maintaining diverse pigeonpea germplasm is supported by research conducted by Dhanapal et al. (2022), who evaluated a large collection of pigeonpea accessions maintained at the ICRISAT genebank. Their

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

findings demonstrated considerable variability in agronomic and nutritional characteristics, indicating that germplasm collections contain valuable genetic resources for identifying accessions with desirable characteristics.

Similarly, Yohane et al. (2022) examined the genetic diversity and grouping of pigeonpea germplasm using molecular markers and agronomic characteristics. Their study demonstrated the usefulness of combining morphological and molecular information to understand genetic relationships among accessions. Although molecular characterization is not included in the present study, their findings emphasize the importance of collecting and evaluating diverse planting materials.

- *Genetic Diversity and Characterization of Pigeonpea Germplasm*

Genetic diversity refers to the variation in inherited characteristics among individuals or accessions within a crop species. In pigeonpea, this diversity may be expressed through differences in plant height, branching pattern, growth habit, flowering time, maturity, pod characteristics, seed size, seed color, and yield potential.

Characterization of germplasm is necessary to identify and describe the distinguishing characteristics of collected accessions. Morphological and agronomic characterization provides useful information that can be obtained through direct field observations and measurements. These characteristics help determine the performance of different accessions under specific environmental and production conditions.

Dhanapal et al. (2022) evaluated approximately 600 pigeonpea germplasm accessions and reported substantial variation in important agronomic and grain nutritional characteristics. Days to 50% flowering ranged from 67 to 166 days, while days to maturity ranged from 112 to 213 days. The study also reported variation in 100-seed weight and grain yield per plant. These results demonstrate the importance of evaluating individual accessions rather than assuming that all pigeonpea materials have similar growth and productivity.

The presence of variation among pigeonpea accessions provides opportunities for identifying planting materials with desirable characteristics, such as early maturity, better seed production, and improved nutritional composition. For this reason, collecting and evaluating farmer-maintained germplasm from the 2nd District of Ilocos Sur may provide useful baseline information for future crop improvement and conservation activities.

- *Agronomic Characteristics and Growth Performance*

Agronomic characterization involves the evaluation of plant growth, development, and other characteristics that influence crop productivity. In pigeonpea, commonly observed characteristics include plant height, number of branches, days to flowering, days to maturity, growth habit, and other morphological features.

Plant height is an important growth characteristic because it reflects the vegetative development of the crop. Differences in plant height among accessions may be associated with genetic characteristics and environmental conditions. The number of branches is also an important parameter because branches provide additional sites for flowering and pod formation, although excessive vegetative growth does not always result in higher seed yield.

Flowering time and maturity are important characteristics in evaluating the adaptability of pigeonpea accessions. Early-flowering and early-maturing accessions may be useful in areas with limited growing periods or unpredictable rainfall. On the other hand, accessions with longer maturity periods may have more time for vegetative growth and reproductive development under favorable conditions.

Dhanapal et al. (2022) reported considerable differences in flowering time and maturity among pigeonpea germplasm accessions. Their findings indicate that genetic variability influences the growth and development of pigeonpea and supports the evaluation of different accessions under common field conditions.

For the present study, plant height, number of branches, days to 50% flowering, days to maturity, and other observable morphological characteristics will be recorded to determine the differences in growth performance among collected accessions under organic farming conditions in Cervantes, Ilocos Sur.

- *Yield Components and Seed Productivity of Pigeonpea*

Seed yield is an important indicator of the productivity and agricultural potential of a pigeonpea accession. It is influenced by several yield components, including the number of pods per plant, number of seeds per pod, seed size, and individual plant productivity.

The number of pods per plant is an important yield component because it represents the reproductive output of the plant. The number of seeds per pod also contributes to the total number of seeds produced. Meanwhile, 100-seed weight provides an indication of seed size and is useful in comparing the physical characteristics of different accessions.

Dhanapal et al. (2022) reported substantial differences in 100-seed weight and grain yield per plant among pigeonpea germplasm accessions. Their findings demonstrate that different accessions may possess varying yield potential and that systematic field evaluation is necessary to identify promising planting materials.

Saxena et al. (2023) also discussed the relationship between nutritional improvement and agronomic performance in pigeonpea. Their review presented high-protein pigeonpea lines that maintained considerable grain productivity, demonstrating the possibility of improving nutritional characteristics without necessarily sacrificing yield.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

In the present study, the number of pods per plant, seeds per pod, 100-seed weight, seed yield per plant, seed yield per plot, and estimated yield per hectare will be evaluated. These measurements will provide information on the productivity of each collected accession under the same field management conditions.

- *Nutritional and Biochemical Composition of Pigeonpea Seeds*

Pigeonpea seeds are recognized as an important source of plant-based nutrients. Their nutritional composition generally includes moisture, crude protein, crude fat, crude fiber, ash, and carbohydrates. These components provide information about the nutritional characteristics and potential food value of the seeds.

Proximate analysis is commonly used to determine the basic nutritional composition of food materials. Moisture content indicates the amount of water present in the seed sample and is important in determining seed storage stability. Crude protein estimates the protein content, while crude fat measures the lipid fraction. Crude fiber provides an estimate of certain structural components, whereas ash represents the total inorganic residue remaining after complete combustion of the sample. Carbohydrates may be estimated by difference when the laboratory follows the appropriate analytical procedure.

Saxena et al. (2023) reviewed the nutritional characteristics of pigeonpea and discussed the variation in seed protein content among different genetic materials. They reported that conventional pigeonpea types generally contain approximately 20–22% protein, while selected high-protein breeding lines may reach approximately 28–30%. Their findings demonstrate that pigeonpea germplasm can vary considerably in nutritional characteristics.

More recent evidence was presented by Dhanapal et al. (2022), who evaluated grain nutritional variability among pigeonpea accessions. Their study reported protein content ranging from 23.35% to 29.50%, together with variation in phosphorus, potassium, calcium, magnesium, iron, zinc, manganese, and copper. This indicates that pigeonpea germplasm may differ not only in agronomic performance but also in its nutritional composition.

Ujinwal et al. (2025) further investigated the genetic basis of protein content, phenolic content, and seed quality characteristics in pigeonpea using molecular and genetic approaches. Their work highlights the importance of understanding the genetic factors associated with nutritional quality and the potential of using diverse pigeonpea materials for improving seed characteristics.

These studies support the inclusion of biochemical analysis in the present research. Determining the proximate composition of collected pigeonpea seeds before planting and again after harvest will provide information on the nutritional characteristics of the original seed materials and the seeds produced following field cultivation.

- *Genetic Variation in Protein and Nutritional Quality*

Nutritional composition is an important consideration in the evaluation of crop germplasm. Differences in protein, carbohydrate, mineral, and other biochemical components may be associated with the genetic characteristics of individual accessions.

Saxena et al. (2023) explained that pigeonpea contains substantial amounts of protein and that genetic improvement can increase protein concentration in selected lines. Their review also discussed the distribution of proteins within different seed structures, emphasizing the importance of seed composition in determining nutritional quality.

Dhanapal et al. (2022) demonstrated that considerable differences exist in protein and mineral content among pigeonpea germplasm accessions. Their findings suggest that the genetic diversity maintained in germplasm collections may serve as a source of nutritionally valuable planting materials.

In addition, Mashifane et al. (2024) examined differences in grain protein and mineral concentrations among fourteen landraces. The findings highlighted the existence of nutritional variation among locally maintained planting materials and the importance of evaluating landraces as potential sources of desirable nutritional traits.

These findings are relevant to the present study because the collected accessions from the 2nd District of Ilocos Sur may also possess differences in their biochemical composition. Determining these differences will help establish baseline information on the nutritional characteristics of locally available pigeonpea germplasm.

- *Effects of Growing Environment and Seed Development on Biochemical Composition*

The biochemical composition of seeds may be influenced by both genetic and environmental factors. Genetic characteristics determine the potential nutritional composition of an accession, while environmental conditions and crop management practices may influence the accumulation and distribution of nutrients during seed development.

Factors such as soil fertility, moisture availability, temperature, crop growth duration, and seed maturity may influence the physiological and biochemical processes involved in seed formation. Changes in these factors may affect the accumulation of protein, carbohydrates, lipids, and other nutritional components.

Saxena et al. (2023) discussed changes in protein and starch accumulation during pigeonpea seed development. Their review indicates that seed composition is not necessarily constant throughout the development of the seed. Consequently, the maturity and handling of seed samples are important considerations when conducting nutritional analysis.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

A 2025 study on vegetable-type pigeonpea genotypes also reported significant effects of genotype and developmental stage on nutritional characteristics. Protein and carbohydrate concentrations differed between developmental stages, while genotypes exhibited different nutritional responses (Evaluation and molecular characterization of vegetable type pigeonpea genotypes for nutritional quality and yield attributing traits, 2025).

These findings emphasize the importance of using properly matured seeds and consistent sample preparation procedures when comparing biochemical composition. In the present study, the initial and post-harvest seed samples will be analyzed using the same laboratory parameters, analytical methods, reporting units, and sample basis whenever possible.

- *Organic Farming and Sustainable Pigeonpea Production*

Organic farming is a production approach that emphasizes ecological processes, soil health, nutrient recycling, and the use of permitted organic inputs. It promotes sustainable crop production through the application of compost, vermicast, animal manure, and other appropriate organic nutrient sources.

Pigeonpea is potentially suitable for diversified and low-input farming systems because of its nitrogen-fixing ability and adaptability to different environmental conditions. Its cultivation may contribute to the efficient utilization of available farm resources and the diversification of upland agricultural production.

Rao et al. (2002) discussed the potential of pigeonpea for forage and nitrogen production, demonstrating its usefulness beyond grain production. Its biological nitrogen fixation capability contributes to nutrient cycling and makes the crop relevant to sustainable agricultural systems.

Altieri (2004) emphasized the importance of ecological approaches in agricultural production, particularly the utilization of biodiversity and natural processes to improve the sustainability of farming systems.

For the present study, the collected pigeonpea accessions will be evaluated under organic farming conditions in Cervantes, Ilocos Sur. Organic nutrient sources and non-synthetic crop management practices will be applied uniformly across treatments. This will provide information on the performance of the different accessions under the selected organic production conditions.

- *Comparison of Initial and Post-Harvest Biochemical Composition*

Comparing the biochemical composition of seeds before planting and after harvest is important in determining whether measurable differences occur between the original seed materials and the seeds produced following field cultivation.

The initial biochemical analysis will establish the baseline nutritional composition of each collected accession. Following planting, crop growth, reproductive development, and harvesting, representative seed samples will be collected for a second laboratory analysis.

The comparison will focus on the same biochemical parameters, including moisture, crude protein, crude fat, crude fiber, ash, and carbohydrates, depending on laboratory availability. Maintaining consistent analytical procedures and sample preparation is important to minimize differences associated with laboratory methods rather than actual sample composition.

Previous studies have demonstrated that genotype and seed developmental stage may influence pigeonpea nutritional composition (Dhanapal et al., 2022; Saxena et al., 2023). Therefore, differences between initial and post-harvest biochemical results may reflect the combined effects of accession characteristics, seed development, field environment, and crop management.

The comparison should be interpreted carefully because the initial seed samples and harvested seeds represent different seed lots and production histories. Consequently, observed differences will describe changes between the original collected seeds and the seeds produced under the experimental field conditions. They should not automatically be interpreted as changes caused exclusively by organic farming.

For the present study, the initial and post-harvest biochemical results will be compared for each accession using the same analytical basis. The magnitude and direction of differences will be determined through descriptive and appropriate statistical analyses, depending on the availability of independent biological replications.

- *Research Gap and Relevance of the Present Study*

Previous studies have established that pigeonpea possesses considerable genetic variation in agronomic performance and nutritional composition. Research conducted by Dhanapal et al. (2022) demonstrated differences in flowering, maturity, seed weight, yield, protein, and mineral content among a large collection of pigeonpea accessions. Saxena et al. (2023) further emphasized the potential of pigeonpea germplasm for improving nutritional quality while maintaining desirable agronomic characteristics.

However, there remains a need to document and evaluate farmer-maintained pigeonpea germplasm from specific localities, particularly in the 2nd District of Ilocos Sur. Information regarding the identity, origin, agronomic performance, yield characteristics, and biochemical composition of these locally available accessions is limited.

The present study will address this information gap by collecting and documenting pigeonpea germplasm from selected municipalities of the 2nd District of Ilocos Sur. The collected seed accessions will undergo initial biochemical analysis before planting and will subsequently be evaluated under organic farming conditions in Cervantes, Ilocos Sur.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

Agronomic characteristics, growth performance, yield components, and seed yield will be recorded during field evaluation. After harvesting, representative seed samples will undergo biochemical analysis using the same laboratory parameters applied to the initial seed samples.

Through this integrated approach, the study will provide baseline information on the diversity, agronomic performance, productivity, and biochemical composition of locally collected pigeonpea germplasm. The findings may contribute to the conservation and utilization of local genetic resources and provide a scientific basis for identifying promising pigeonpea accessions for further evaluation under organic farming conditions in Cervantes, Ilocos Sur.

III. MATERIALS AND METHODS

➢ *Research Design*

The study will be conducted in four major phases: (1) collection and documentation of pigeonpea germplasm from the 2nd District of Ilocos Sur; (2) initial biochemical analysis of the collected seed samples before planting; (3) field establishment, agronomic characterization, and yield evaluation under organic farming conditions in Cervantes, Ilocos Sur; and (4) post-harvest biochemical analysis and comparison of seed composition.

The field experiment will be laid out using a Randomized Complete Block Design (RCBD) with three replications. Each collected pigeonpea accession will serve as a treatment. The final number of treatments will depend on the number of distinct accessions successfully collected and having sufficient viable seeds for laboratory testing and field planting.

➢ *Study Area and Duration*

Germplasm collection will be undertaken in selected municipalities of the 2nd District of Ilocos Sur. The field experiment will be established in Cervantes, Ilocos Sur. The study is scheduled from April to December 2027, subject to seed availability, field conditions, and laboratory schedules.

➢ *Germplasm Collection and Documentation*

Pigeonpea seed samples will be collected from farmers, backyard growers, and community seed sources in selected municipalities of the 2nd District of Ilocos Sur. Collection sites will be selected based on the presence of pigeonpea plants or available farmer-maintained seed stocks. Farmer recommendations and local agricultural contacts may be used to identify potential sources.

Each distinct seed sample will be assigned a unique accession code.

The following passport information will be recorded:

- Accession number or code;
- Municipality and barangay of collection;
- Name or description of the source or farmer, subject to consent;
- Local name of the variety or planting material;
- Collection date;
- Geographic coordinates and elevation, if available;
- Source of seed (farmer-saved, purchased, or other source); and

Available information on cropping system and farmer production practices.

Collected seeds will be placed in clean, labeled containers or bags and transported carefully. Seed lots will be kept separate to avoid mixing. The seeds will be inspected, cleaned, and stored under suitable conditions until initial biochemical analysis and planting. Where possible, sufficient seed from each accession will be collected to provide samples for laboratory testing, field planting, and reserve storage.

➢ *Initial Biochemical Analysis Before Planting*

Before field planting, a representative seed sample from each accession will be prepared and submitted to a qualified laboratory for initial biochemical or proximate composition analysis. The purpose of this analysis is to establish the baseline composition of the collected seed lots.

- *The Proposed Parameters are:*

Table 1 Initial Biochemical Analysis Before Planting

Parameter	Unit	Purpose
Moisture content	%	Determines the moisture level of the seed sample.
Crude protein	%	Estimates protein content.
Crude fat	%	Estimates lipid content.
Crude fiber	%	Estimates crude fiber content.
Ash	%	Estimates total inorganic residue after ashing.
Carbohydrates	%	May be calculated by difference, according to the laboratory method.

The final list of parameters will be confirmed with the receiving laboratory based on available equipment, standard methods, and budget. The same parameters, analytical methods, sample basis (for example, as-is or dry-weight basis), and reporting units must be used for the post-harvest analysis. Each accession will be clearly identified on the laboratory submission form. If sufficient seed is available, the laboratory may conduct replicate determinations for each accession. These are laboratory or analytical replicates and should not automatically be treated as independent biological field replications.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

➢ *Materials:*

The materials and supplies will include:

- Collected pigeonpea seed accessions;
- Organic fertilizers or soil amendments, such as compost or vermicast, as appropriate;
- Farm tools and equipment for land preparation and crop maintenance;
- Field labels, plot stakes, measuring tools, and data-recording sheets;
- Clean sample bags or containers for seed collection and storage; and
- Laboratory services and materials required for the selected biochemical analyses.

- *Experimental Design and Treatments*

The field experiment will be arranged in an RCBD with three replications. Each pigeonpea accession will constitute one treatment. The treatments will be identified as follows:

T1 = Accession 1; T2 = Accession 2; T3 = Accession 3; …; Tn = Accession n.

The treatments will be randomized separately within each block. Plot dimensions, alleyways, and the total experimental area will be finalized after the number of accessions and available field area are confirmed. The same planting distance and crop management practices will be applied to all treatments.

- *Field Establishment and Crop Management*

The experimental area will be prepared using appropriate land preparation practices. The field will be divided into three blocks, and each block will contain one plot for every accession. Seeds will be planted at a proposed spacing of 1.0 m × 0.5 m, subject to adjustment based on local recommendations and available field conditions. Two to three seeds may be sown per hill, followed by thinning after establishment to maintain one healthy plant per hill.

Organic fertilizers, such as compost or vermicast, will be applied uniformly based on the selected organic production protocol and soil or site conditions. No synthetic fertilizers or pesticides will be used if the experiment is maintained under the stated organic management conditions. Weeds will be controlled manually or through other approved non-synthetic practices. Irrigation will be provided as needed, and all crop management activities will be recorded and applied consistently across treatments.

IV. DATA COLLECTION

➢ *Agronomic and Growth Parameters*

Data will be collected from representative plants in the net plot area. The number of sample plants per plot will be determined before data collection and kept consistent across all treatments. The following parameters will be recorded:

- Plant height (cm) – measured from the soil surface to the growing tip at specified growth stages or at maturity;
- Number of branches per plant – counted on each sample plant;
- Days to 50% flowering – number of days from planting until approximately 50% of the plants in a plot have at least one open flower;
- Days to maturity – number of days from planting until the pods reach harvest maturity; and
- Other distinguishing morphological observations, such as growth habit, flower color, pod characteristics, and seed color, where applicable.

➢ *Yield Components and Seed Yield*

- Number of pods per plant – total mature pods counted from each sample plant;
- Number of seeds per pod – determined by counting seeds from a representative pod sample;
- 100-seed weight (g) – weight of 100 clean seeds at a standardized moisture condition;
- Seed yield per plant (g) – total clean seed weight obtained from each sample plant; and
- Seed yield per plot and estimated yield per hectare (kg/ha) – determined from the harvested net plot area and converted to a hectare basis.

Harvesting will be conducted when the pods have reached the appropriate maturity stage. Harvested pods will be dried as required, threshed, cleaned, and weighed. Seed moisture content should be measured or standardized when comparing seed weights and yield. The net plot area and any border rows excluded from yield measurement will be recorded.

- *Post-Harvest Biochemical Analysis*

After harvest, representative seed samples from each accession will be collected separately from each field replication, where sample quantity permits. The samples will be labeled with the accession code, block or replication number, and harvest date. Seeds will be cleaned and prepared according to the receiving laboratory's sample-preparation requirements.

The post-harvest seed samples will be submitted to the same laboratory for analysis of the same biochemical parameters measured before planting: moisture, crude protein, crude fat, crude fiber, ash, and carbohydrate (if included in the initial analysis). The same analytical methods, reporting units, and sample basis will be requested to ensure comparability.

The initial results will represent the biochemical composition of the collected seed lots before planting, while the post-harvest results will represent the composition of seeds produced after the accessions have been grown under the field conditions of the study. Differences will be examined for each parameter and accession. Such differences will be interpreted as changes observed between the original seed lots and harvested seed under the study

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

conditions, not as proof that field cultivation alone caused the changes.

- *Sample Handling and Quality Control*

Maintain a unique accession code from collection through laboratory submission and final data analysis.

Keep seed samples from different accessions and field replications separate.

Use clean, dry, properly sealed containers and protect samples from moisture, pests, and contamination.

Coordinate sample quantity, drying or conditioning requirements, and storage instructions with the laboratory before submission.

Request the laboratory to report the analytical method, units, and sample basis for every parameter.

Use the same laboratory and analytical procedures for initial and post-harvest samples whenever possible.

V. STATISTICAL ANALYSIS

➢ *Agronomic Characteristics and Yield Components*

Data on agronomic characteristics, yield components, and seed yield will be subjected to Analysis of Variance (ANOVA) appropriate for an RCBD. The following model will be used:

$$Y_{ij} = \mu + T_i + B_j + \varepsilon_{ij}$$

Where:

Y_{ij} = observed value of the ith accession in the jth block;

μ = overall mean;

T_i = effect of the ith accession;

B_j = effect of the jth block; and

ε_{ij} = experimental error.

When the ANOVA indicates significant differences, treatment means will be compared using an appropriate mean-comparison procedure, such as Least Significant Difference (LSD), at the 5% level of significance, subject to the assumptions of the analysis.

➢ *Initial and Post-Harvest Biochemical Composition*

Biochemical results will be tabulated by accession, sampling stage, and laboratory replicate or field replication, as applicable. For each parameter, the initial and post-harvest values will be compared to describe the direction and magnitude of observed differences.

Where the sampling structure provides suitable independent replication, the data may be analyzed using an appropriate model that accounts for accession and sampling stage (initial versus post-harvest), including their interaction. If only one collected seed lot is available per accession before planting, the initial result will be treated as a baseline measurement for that seed lot. Laboratory repeat determinations of the same seed lot are technical replicates and do not provide independent biological replication. In that case, inferential tests of change will be interpreted cautiously, and descriptive comparisons (means, differences, and percentage changes) will be emphasized.

➢ *Percentage change may be calculated as:*

Percentage change = [(Post-harvest value − Initial value) / Initial value] × 100

The percentage-change calculation will be used only when the initial value is greater than zero and both measurements are reported on the same analytical basis.

➢ *Organic Farming Compliance*

Field operations will follow the organic management practices specified for the experiment. Organic nutrient sources will be used, synthetic fertilizers and pesticides will be excluded, and weed management will rely on manual or other permitted non-synthetic practices. Inputs and field activities will be documented throughout the experiment.

➢ *Conceptual Flow of the Study*

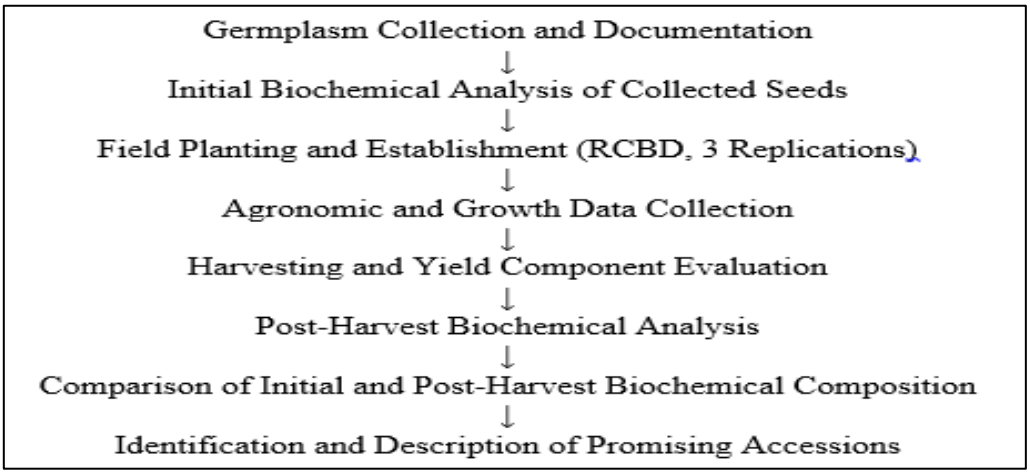

Fig 1 Conceptual Flow of the Study

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

➢ *Proposed Work Plan*

The following schedule is proposed for April to December 2027. Actual timing may be adjusted depending on the availability of germplasm, rainfall, crop duration, and laboratory schedules.

Table 2 Proposed Work Plan

Period	Major Activity	Expected Output
April–May 2027	Coordination with municipalities and farmers; collection and documentation of pigeonpea germplasm.	Labeled and documented seed accessions.
May–June 2027	Initial biochemical analysis; seed preparation; field preparation and layout.	Baseline biochemical results and prepared experimental area.
June–July 2027	Planting and establishment of accessions under RCBD.	Established field experiment.
July–October 2027	Crop maintenance and collection of agronomic and growth data.	Agronomic and growth data.
October–November 2027	Harvesting; collection of yield component and seed yield data; preparation of seed samples.	Yield data and post-harvest seed samples.
November–December 2027	Post-harvest biochemical testing, data analysis, interpretation, and report preparation.	Comparative biochemical results and completed research report.

VI. CONCLUSION

This proposed research will provide a systematic assessment of pigeonpea germplasm collected from selected municipalities of the 2nd District of Ilocos Sur. By documenting the origin and identity of each accession, the study will help establish baseline records of locally maintained planting materials that may otherwise remain insufficiently characterized. The initial biochemical analysis will describe the nutritional composition of the collected seed lots before planting, while field evaluation in Cervantes, Ilocos Sur, will provide information on their growth, development, yield components, and seed productivity under the same organic farming conditions. Post-harvest biochemical analysis using the same laboratory parameters will allow the harvested seeds to be compared with the original collected seed samples. The comparison will be interpreted in consideration of differences in seed lot, seed development, field environment, and sample handling, and will not be taken as proof that organic farming alone caused any observed change. Through these activities, the study is expected to identify variations among accessions and generate useful baseline information for future research, conservation, and possible utilization of pigeonpea in local farming systems. The results may also guide further evaluation of promising accessions for diversified, organic, and upland agriculture in Cervantes and other areas with similar production conditions. Since this is a research proposal, the final conclusions and recommendations will be formulated after the actual collection, field evaluation, laboratory analyses, and statistical interpretation of the data have been completed.

REFERENCES

[1]. Dhanapal, S., Thiyagarajan, K., Ramachandran, S., Vetriventhan, M., Swaminathan, M., Prabhakaran, J., Bellie, A., Reddymalla, S., Choudhari, P. L., Nimje, C. A., Peerzada, O. H., Arveti, V. N., Azevedo, V. C. R., & Singh, K. (2022). Grain nutrients variability in pigeonpea genebank collection and its potential for promoting nutritional security in dryland ecologies. Frontiers in Plant Science, 13, 934296. https://doi.org/10.3389/fpls.2022.934296

[2]. Mashifane, D. C., Chiulele, R. M., & Gwata, E. T. (2024). Diversity in selected grain mineral and protein among pigeonpea landraces. Applied Sciences, 14(2), 573. https://doi.org/10.3390/app14020573

[3]. Saxena, K. B., Reddy, L. J., & Saxena, R. K. (2023). Breeding high-protein pigeonpea genotypes and their agronomic and biological assessments. Plant Breeding, 142(2), 129–139. https://doi.org/10.1111/pbr.13082

[4]. Ujinwal, M., Singh, N., Langyan, S., & Singh, N. K. (2025). Genetic dissection of total protein content, phenolic content and seed quality traits in pigeonpea (Cajanus cajan) using 62K pigeonpea genic SNP chip. Molecular Genetics and Genomics, 300(1), Article 44. https://doi.org/10.1007/s00438-025-02235-9

[5]. Yohane, E. N., Shimelis, H., Laing, M., & Shayanowako, A. (2022). Genetic diversity and grouping of pigeonpea [Cajanus cajan Millspaugh] germplasm using SNP markers and agronomic traits. PLOS ONE, 17(11), e0275060. https://doi.org/10.1371/journal.pone.0275060

[6]. Altieri, M. A. (2004). Agroecology: The science of sustainable agriculture (2nd ed.). Westview Press.

[7]. Bernabe, J. A. (2019). Promising pigeonpea (Cajanus cajan L.) genotypes in Ilocos Region, Philippines. Philippine Journal of Crop Science, 44(Supplement 1), 144–145.

[8]. Commission on Genetic Resources for Food and Agriculture. (2010). The second report on the state of the world's plant genetic resources for food and agriculture. Food and Agriculture Organization of the United Nations.

[9]. Nene, Y. L., & Sheila, V. K. (1990). Pigeonpea: Geography and importance. In Y. L. Nene, S. D. Hall, & V. K. Sheila (Eds.), The pigeonpea (pp. 1–14). CAB International.

[10]. Rao, S. C., Northup, B. K., & Mayeux, H. S. (2002). Forage and nitrogen production of pigeonpea in the

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov690

Southern Great Plains. Agronomy Journal, 94(6), 1228–1235.
[11]. Saxena, K. B., Kumar, R. V., & Rao, P. V. (2002). Pigeonpea nutrition and its improvement. Journal of Crop Production, 5(1–2), 227–260.
[12]. Upadhyaya, H. D., Bramel, P. J., & Singh, S. (2006). Development of a core subset of pigeonpea germplasm. Field Crops Research, 95(2–3), 192–201.
[13]. Upadhyaya, H. D., Reddy, K. N., & Singh, S. (2011). Genetic resources of pigeonpea. Legume Perspectives, 1, 23–24.