BIBLIOGRAPHY

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ABSTRACT

Seven pigeon pea accessions from Batac, Ilocos Norte and from Kapangan, Benguet were used in this study.

The study aimed to: morphologically characterize pigeon pea accessions; to evaluate the yield and; to identify the best performing pigeon pea accessions under Datakan, Kapangan, Benguet.

Significant differences were observed on the morphological characters of the eight pigeon pea accessions. ICPL 7035-9 was the earliest to produce flower and first to bear pods. “Seng-ewan” produced the highest seed yield in terms of green shelled and dry seeds and weight of 100 seeds, highest in raceme number as well as number of secondary branches and tallest at initial and final plant height.

Accessions ICPL 87119-8 and ICPL 8863-10 had also good performance, but “Seng-ewan” had the best growth and seed yield performance. Thus, it was highly adaptable in Datakan, Kapangan, Benguet.

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INTRODUCTION

Pigeon pea (*Cajanus cajan* L. Millsp) belongs to family Leguminosae which is a perennial legume shrub and locally called "cadios or cardis". It is a grain legume of considerable importance in India and is grown in many other tropical countries from 30 degrees North to 30 degrees South (Saxenal *et al*., 1983). Clearly, pigeon pea is a major pulse crop. As reported by Theisen *et al.* (1978) it was selected as one of the promising "new" crops for the United States.

This crop was ranked third behind chickpea and black gram in 1986. Pigeon pea is used as a substitute for chick pea by poorer consumers and on a wider scale when they are in short supply. On the other hand, pigeon pea has more limited number of traditional use (Wallis *et al*, 1988). Dry pigeon peas are a well established foodstuff. Its seeds contain 20%-25% protein, rich in carbohydrates and minerals. These also supplement the limited supplies of animal proteins such as meat, milk, eggs and fish. As a leguminous crop, it is effective contributor to soil Nitrogen. This plant thrives in a soil with pH 5.0-7.0 and is sensitive to salinity.

According to past studies, the principal constraint in growing pigeon pea as major crop is low yield (Saxenal *et al*, 1983). Low yield could be due to several factors. One factor is the crop's susceptibility to water logging, frost and insect attack (Wallis *et al*., 1988).

Growers can not exactly identify variety which gives high yield with quality pods, therefore, it is important to note some of morphological characteristics of the crops.

The morphological characterization of accessions in the collection is essential not only to have a description of each accession but also to use this information to identify

duplicate accessions. These data should be recorded on plants from all accessions in the collection grown under the same environment, under the same plant density, and in the most favorable season for good plant development (Huaman, 2007).

For the purpose of characterizing a variety collection, sufficient number of traits are included that are useful in eliminating duplicates, establishing the identity of an accession, and assessing its agronomic and utilization potential (Rasco and Amante, 1994).

As cited by Wallis *et al* (1988) evaluation on pigeon pea was designed to enable collaborating scientists to develop an understanding of the crop, and also to identify genetic material that would fit into existing and new cropping systems.

In a germplasm collection it is important to identify possible duplicates. If varieties are characterized, information exchange of genetic resources is more accessible to other researchers (Borromeo *et al*, 1994). It is also important in the field of agriculture for breeders, researchers to further evaluate the characteristics of existing varieties.

The objectives of the study were to:

1. to morphologically characterize pigeon pea accessions;

2. to evaluate the yield of pigeon pea accessions under Datakan, Kapangan, Benguet; and

3. to identify the best performing pigeon pea accessions planted under Datakan, Kapangan,Benguet.

This study was conducted at Datakan, Kapangan, Benguet from September 2007 to April 2008.

REVIEW OF LITERATURE

Botanical Description

Pigeon pea is an erect shrub or short lived perennial legume often grown as annual crop. This plant is very deeply rooted, and thus tolerate prolong dry periods between rains (AID, 1975). It has well developed tap root system, typical of dicotyledons with lateral branching. Perhaps due to the perennial nature of the plant, roots continue to accumulate dry matter and produce lateral through out its growth (Salam *et al*, 1993). Singh (1983) cited that the length of the lateral root differs with the variety, usually tall upright varieties produce longer and more deeply penetrating roots, whereas spreading types produce shallower, more spreading and denser roots. Leaves are trifoliate compound, the central leaflet longer than lateral lobes. These are densely silky on the lower surface, stipules are small and lamina hairy with the under surface grayish due to dense hairs. However, the intensity of the green color of leaves, leaf length, size, shape and texture differ with the variety (Singh, 1983). Leaflets are elliptical which measures 3-13.17cm X 1.3-5.7cm. Flowers are distinctly Papillionaceous, and are usually grouped together at the end of branches. Flower color may be yellow or red. Pods measures 5-8 cm long, with four to seven seeds per pod. This may be straight or sickle-shaped with globose to ellipsoid squarish seeds. Seeds are white, cream, brown, and purplish to almost black or mottled. On the other hand, pods and seeds may vary from violet to green, wherein the green ones are more nutritious (PROSEA, 1999).

The maturity of this plant ranges from 95-256 days in normal conditions. With short days, growth in length is less and flowering is accelerated (CGPRT, 1989). Growth of pigeon pea is arrested and may cease where dry season exceeds 6 months. Under

grazing or cutting, they produce new shoots near ground level or along main stem (Crowder, 1982).

As a multipurpose crop, pigeon pea is also used as a food and cover crop, the crop is well known but ought to be promoted especially in more semi-arid regions of Indonesia and the Philippines. It fits in small holders garden cropping and along hedges and bunds of rice fields. The branches and stem can be used for baskets and fuels, it is often grown as a shade crop, cover crop or wind break. (CGPRT, 1989). Pigeon pea produce "peas" for human consumption, pod husk and leaves for animal fodder and sticks for firewood, they are sown along contour provide extra browsing, and protein supplement for cattle grazing natural grassland during dry season (Rocheleau *et al*, 1988). In traditional uses, young leaves of the plant are used as medicine. PCARRD (1982) reported that among agro-forest legumes, pigeon pea appears to be the most acceptable to "kaingineros" both as productive and protective cover. Many "kainginerous" are already using pigeon pea as a component of their agroforestry system. On the other hand, among plants used by man, legumes rank second to grasses in terms of importance because they are one of the major source of protein for both men and animal.

Pigeon pea plays also an important role in soil for they serve as a fertilizer and nitrogen fixers. The greatest potential for future increases in agricultural and productivity lies in upland or rainfed lands. As cited by Wallis *et al* (1998) among many other uses of pigeon pea it is use as green manure crops that helps in replenishing soil nutrients.

Pigeon pea as one of the agro-forest legumes are of greater importance in term of nitrogen fixation. This plant helps tremendously in generating degraded uplands, recycling nutrients and improving soil and controlling weeds. Agro-forest legumes such

pigeon pea is critical to the nitrogen balance in nature because most legumes are capable of fixing atmosphere nitrogen (PCARRD, 1982).

Characterization and Evaluation Done on Pigeon Pea and Other Legumes

Characterization is based on agro-morphological characteristics of plants. Standardized descriptions are used to characterize materials so that information exchange of genetic resources is more accessible to researchers and plant breeders. Breeders could use them as resources for exploiting new traits that is desirable and related to yield. Characters of importance should be identified to correlate with yield and later improvement could be done (Borromeo *et al*, 1994). As cited by Rasco and Amante (1994) traits are used for characterization. However, are generally stable than other traits and not be of maximum benefit to researcher.

Characterization data are used for the following purposes: to eliminate duplicates in a collection; to assess the agronomic and utilization potential of an accession; to check the accuracy of labeling in field experiments; and to serve as a basis for rouging mixtures in multiplication on fields.

An evaluation conducted at Thailand and Indonesia confirmed that later maturing types were not desirable in Thailand or in some production system in Indonesia owing to excessive vegetative growth coupled with delayed maturity. On the other hand, the production system with greatest potential for pigeon pea are short season, photo period – insensitive types planted as wet season crops on the upper paddy or upland areas of Northern Thailand, short season and late maturing types planted as intercrops in rubber plantations, crop produced as a green vegetable on a small scale (Wallis *et al*, 1988).

Rice Bean

Result on the study conducted by Ignacio (2005) on rice bean showed that significant differences were noted among the accessions that were collected from different municipalities of Benguet for most morphological characters except for the stem diameter, number of nodes, inflorescence length, number of seeds per pod and pod width.

High variation within the collection was also observed for qualitative characters such as cotyledon color, leaf shape, flower bud size, pod curvature and seed color in the diversity analysis.

The different rice bean accessions significantly differed for number of days from emergence to flowering, pod setting, and seed filling, likewise the accession differ in the number of days from first flowering to last flowering. The rice bean accession from Bila, Bokod, Benguet was the earliest to mature. It took the accessions 78 days to produce flower. On the other hand, late maturing accessions from Tinongdan, Itogon, Benguet flowered in 87 days. Accessions from Ambongdolan, Tublay, Benguet significantly produced the heaviest seeds with 14.78g while Rb_1 produced the lightest seeds.

On other study, Datol (2004) pointed out that Tabuk rice bean variety was the earlier to reach harvest stage produced longer vine, longer pods and high percentage seed germination than Sabangan, in terms of yield, Sabangan out yielded Tabuk by About 75%.

Lima Beans

A characterization and evaluation on lima bean as worked out by Sagayo (2006), and differences were observed for number of days from emergence to flowering, pod setting and seed filling while in number of days from flowering to first harvest most of

the accessions are comparable to each other. LBO_2 and LBO_5 took 75 days to flower and were the earliest to mature. LBO_5 was recorded a late maturing accession. LBO_6 out performed other accessions which had the following characteristics: tallest plant at 35 DAP; longest bud; widest leaves; longest leaves; and produce the heaviest seeds.

It was observed that the eight lima bean accessions differed significantly for morphological characters such as number of days from emergence, pod setting, seed filling, leaf area, leaf length, pod width and length, seed width and weight of 100 seeds. LBO_6 exhibit the best performance in terms of plant height, leaf area and width, number of flower buds per cluster, pod width and length and weight of 100 seeds

MATERIALS AND METHODS

An area of 240 square meters was properly cleaned and divided into 24 plots. Each plot has a measurement of 1m x $10m^2$. This experiment was laid-out using randomized complete block design (RCBD) with three replications.

Treatments

The seven pigeon pea accessions were acquired from MMSU, Batac, Ilocos Norte while the check variety (Seng-ewan) was acquired from Kapangan, Benguet.

ACCESSION

A_1: ICPL 7035-9

A_2: ICPL 8863-10

A_3: ICPL 88039

A_4: ICPL 20092-6

A_5: ICPL 87034

A_6: ICPL 87119-8

A_7: ICPL 85063-19

A_8: "Seng ewan"

To ensure growth and yield, cultural management practices such as irrigation, weeding, side dressing and hilling up, insects and disease control were strictly observed.

Data Gathered

The descriptors according to ICRISAT and International Board on Pant Genetic and Resources (1993) were followed.

1. Maturity

a. Days to emergence. This was taken by counting the number of days from planting to the time when at least 50% of the plants emerged.

b. Number of days from emergence to flowering. This was recorded by counting the number of days from emergence to the time when at least 50% of the plants flowered.

c. Number of days from emergence to pod setting. This was recorded by counting the number of days from emergence until pods were fully developed.

d. Number of days from emergence to seed filling. This was obtained by counting the number of days from emergence until 75% of pods filled with seeds.

2. Stem Characters

a. Growth habit. This was observed when the plants are fully established and were measured using the following scale:

SCALE	DESCRIPTION
1	Erect and compact
2	Semi-spreading
3	Spreading
4	Trailing

b. Initial plant height (cm). The initial plant height was measured 4-6 weeks after planting from three sample plants in each plot.

c. Final plant height (cm). The height of the plant was measured from the cotyledon scar to tip of plants using a thread and foot ruler from three sample plants per plot.

d. Stem thickness (mm). The thickness of stem was measured at the mid-portion of stem using a vernier caliper when plants are fully matured using the following scale:

SCALE	DESCRIPTION
3	Thin (<5mm)
5	Intermediate (5-13mm)
7	Thick (>13mm)

e. Stem color. The stem color of the plant at maturity was recorded using the following scale:

SCALE	DESCRIPTION
1	Green (yellow green group)
2	Sun red (grayed red group)
3	Purple (grayed purple group)
4	Dark purple (grayed purple)

f. Number of secondary branches. Secondary branches were taken by counting the number of branches born on primary branches.

3. Leaf Characters

a. Leaflet shape. This was identified when most leaves unfold, using the scale lanceolate, elliptic, narrow-elliptic, broad-elliptic, or obcordate.

b. Leaf hairiness. This was observed from the lower surface of the leaves using the following scale:

SCALE	DESCRIPTION
1	Glabrous
2	Pubescent

4. Flower Characters

a. Base flower color. This was taken from the main color of the petals given the color codes; ivory, light yellow, yellow and orange yellow.

b. Color of flower keel. Color of the keel was observed just before the flower opens, recording whether red, purple or yellow.

c. Pattern of streaks. Pattern of flower color was taken on the dorsal side of the flag (standard petal), whether the pattern of streaks are sparse, medium amount of streaks, dense streaks, uniform coverage of second color.

d. Flowering pattern. This was taken just before the flower opens using the scale determinate, semi-determinate, and indeterminate.

e. Second Flower Color. The color of streaks on dorsal side of the vaxillum (flag) and second color of the wings and keel were taken when flower opens using the following scale:

SCALE	DESCRIPTION
1	Red (red group 45A)
2	Purple (greyed purple group 186 A)
3	Yellow (Yellow- orange group 14 A)

f. Raceme Number. An average number of racemes were recorded when plants starts to flower from three randomly selected plants in a row.

5. Pod Characters

a. Pod color. The main color of pods at its physical maturity were taken using the following scale

SCALE	DESCRIPTION
1	Green(Yellow Green Group)
2	Purple(Grayed purple Group)
3	Mixed, Green and purple
4	Dark purple(Grayed purple group)

b. Pod length (cm). A ten sample of the largest fully expanded immature pods were picked at random from each plot and were measured from base to the tip.

c. Pod form. A ten sample of immature pods were picked at random from each plot and were recorded whether flat or cylindrical.

d. Pod width (cm). This was measured using a ruler from the largest fully expanded immature pods.

e. Pod hairiness. This was observed in pods whether glabrous or pubescent.

f. Pod bearing length (cm). The bearing distance of the plant was measured from the lowest to the topmost pod on the plant.

6. Seed Characters

a. Seeds per pod. This was obtained by getting average of ten randomly selected pods from three randomly selected plants in a row.

b. Seed color pattern. The color of the seed pattern was recorded when pods are fully matured using the following scale:

SCALE	DESCRIPTION
1	Plain
2	Mottled

SCALE	DESCRIPTION
3	Speckled
4	Mottled and Speckled
5	Ringed

c. Seed shape. This was taken just after pods opened using the following scale:

SCALE	DESCRIPTION
1	Oval (egg shaped)
2	Globular (pea shaped)
3	Square (angular)
4	Elongate

d. Base seed color. This was taken by recording the color of seed base using the following scale:

SCALE	DESCRIPTION
1	White
2	Cream
3	Orange
4	Light brown
5	Reddish brown
6	Light gray
7	Grey
8	Purple
9	Dark purple
10	Dark grey

7. Yield and yield components

a. Weight of hundred seeds (g). This was obtained by weighing 100 seeds at 12-14% moisture content.

b. Green-shelled seed yield. This was recorded by determining the weight of green-shelled seeds of ten sample plants.

d. Dry seed yield. This was recorded by determining the weight of dry seeds of ten sample plants.

8. Harvest Index. This was obtained from three randomly selected plants in each accession using the following formula.

$$HI = \frac{S^1DW}{RDW + S_1DW + LDW + PSDW + S_2DW}$$

Where: S_1DW – Seed Dry Weight PSDW – Pod Shell Dry Weight

RDW – Root Dry Weight S_2DW – Stem Dry Weight

LDW – Leaves Dry Weight

9. Pest and disease rating

a. Reaction to legume pod borer. The infestation of legume pod borer was obtained using the following rating scale:

RATING SCALE	REMARKS	DESCRIPTION
1	No infestation	High resistance
2	25% of the total plants was infested	Mild resistance
3	25-50% of the total plants was infested	Moderate resistance

RATING SCALE	REMARKS	DESCRIPTION
4	51-75% of the total plants was infested	Susceptible
5	76-100% of the total plant was infested	Very susceptible

b. Reaction to bean rust. The reaction of infection of bean rust was obtained using the following rating scale:

RATING SCALE	REMARKS	DESCRIPTION
1	No infestation	High resistance
2	25% of the total plants was infested	Mild resistance
3	25-50% of the total plants was infested	Moderate resistance
4	51-75% of the total plants was infested	Susceptible
5	76-100% of the total plant was infested	Very susceptible

Analysis of Data

All quantitative data were analyzed using analysis of variance (ANOVA) for RCBD. The significance of difference among treatment means was tested using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

Maturity Indices

Days of Emergence

Statistical analysis revealed no significant differences on the number of days from sowing to emergence among the eight accessions evaluated. ICPL 20092-6, ICPL 87034 and ICPL 85063-19 were the earliest to emerge within 6 days while the rest of the accessions emerged after five days (Table 1).

Number of Days from Emergence to Flowering

Among the eight accessions of pigeon pea observed, ICPL 7035-9 was the earliest to bear flowers at 115 days after emergence while "Seng-ewan" and ICPL 20092-6 were the latest as shown in Table 1.

Number of Days from Emergence to Pod Setting

Table 1 shows significant differences on the number of emergence to pod setting. ICPL 7035-9 significantly was the earliest to produce pods but comparable with ICPL 88039. On the other hand, ICPL 20092-6 and "Seng-ewan" were the latest to produce pods.

Number of Days from Emergence to Seed Filling

The different pigeon pea accessions significantly differed for number of days from emergence to pod setting. ICPL 7035-9 was the first to be filled with seeds and ICPL 20092-6 was the latest at 150 days after emergence.

Table 1. Maturity indices of eight pigeon pea accessions

ACCESSION	NUMBER OF DAYS TO:			
	EMERGENCE	FLOWERING	POD SETTING	SEED FILLING
ICPL 7035-9	5	115.67[f]	126.00[a]	133.00[a]
ICPL 8863-10	5	126.33[c]	136.00[d]	144.67[e]
ICPL 88039	5	117.33[e]	126.67[ab]	135.00[b]
ICPL 20092-6	6	136.00[a]	144.00[f]	150.00[h]
ICPL 87119-8	6	117.67[f]	127.67[b]	136.33[c]
ICPL 87034	6	132.67[b]	139.00[e]	146.00[f]
ICPL 85063-19	5	120.33[d]	130.67[c]	137.67[d]
Seng- ewan	5	136.33[a]	143.33[f]	149.00[g]
CV (%)	12.63	0.57	0.49	0.24

Means with the same letter are not significantly different at 5% level by DMRT.

Growth Habit

Most of the accessions have erect type of growth except for accession ICPL 20092-6 which has semi-spreading type of growth.

Plant Height and Stem Characters

Initial and Final Plant Height

Table 2 shows the height of plants at 35 and 150 DAP. "Seng-ewan" was recorded to have the tallest plants at 35 DAP with 10.2 cm but comparable with ICPL 7035-9 and ICPL 8863-10. Accession ICPL 85063-19 produced the shortest plants. At 150 DAP, "Seng-ewan" was the tallest among the accessions. Short plants were obtained from ICPL 7035-9 but were comparable to ICPL 85063-19, ICPL 88039, ICPL 20092-6,

ICPL 87034 and ICPL 8863-10. Statistical analysis revealed highly significant differences among the accessions.

Stem Thickness

As shown in Table 2, intermediate stems were obtained from “Seng-ewan” and ICPL 87119-8. Most of the accessions exhibited thin stems.

Stem Color

All of the accessions exhibited green stems.

Number of Secondary Branches

The highest number of secondary branches was obtained from ICPL 20092-6 with eight. Accessions ICPL 7035-9, ICPL 87119-8, and ICPL 8863-10 obtained the lowest number with four branches that are comparable with ICPL 87034 and ICPL 88039.

Leaf Characters

Leaf Shape and Leaf Hairiness

“Seng-ewan”, ICPL 20092-6 and ICPL 85063-19 exhibited a broad elliptic leaf shapes. The rest have elliptic shapes. All of the accessions have pubescent leaves.

Table 2. Plant height and stem characters of eight pigeon pea accessions

ACCESSION	PLANT HEIGTH (cm)		STEM THICKNESS [1/]	NUMBER OF SECONDARY BRANCHES
	35 DAP	150 DAP		
ICPL 7035-9	7.97[b]	56.30[c]	Thin	4[c]
ICPL 8863-10	7.90[b]	79.97[bc]	Thin	4[c]
ICPL 88039	7.27[c]	65.50[bc]	Thin	5[bc]
ICPL 20092-6	5.63[e]	56.50[c]	Thin	8[a]
ICPL 87119-8	7.33[c]	70.43[bc]	Intermediate	4[c]
ICPL 87034	6.27[d]	91.30[ab]	Thin	5[bc]
ICPL 85063-19	7.0[c]	77.30[bc]	Thin	4[c]
Seng- ewan	7.0[c]	113.77[a]	Intermediate	6[b]
CV (%)	2.67	18.07		19.32

Means with the same letter are not significantly different at 5% level by DMRT.
[1/] Thin (<5mm) Intermediate (5-13mm) Thick (> 13mm)

Flower Characters

Color of Standard

Table 3 represents the color of standard observed in pigeon pea accessions characterized. ICPL 7035-9 has the unique standard color of red while the remaining accessions exhibited yellow color.

Base Flower Color and Color of Flower Keel

Base flower and flower keel color of pigeon pea accessions exhibited yellow.

Pattern of Streaks

All the accessions had medium amount of streaks.

Flowering Pattern

Most of the accessions exhibited a determinate type except for ICPL 20092-6 with semi-determinate flowering pattern.

Second Flower Color

All of the accessions have yellow secondary flower color.

Raceme Number

Statistical analysis revealed highly significant differences on raceme number among the eight pigeon pea accessions. "Seng-ewan" and ICPL 87119-8 produced the highest number of raceme. ICPL 7035-9 has the lowest number but comparable with ICPL 8863-10.

Table 3. Color of standard, flowering pattern and raceme number of eight pigeon pea accessions

ACCESSION	COLOR OF STANDARD	FLOWERING PATTERN	RACEME NUMBER
ICPL 7035-9	Red	determinate	19[d]
ICPL 8863-10	Yellow	determinate	22[cd]
ICPL 88039	Yellow	determinate	31[b]
ICPL 20092-6	Yellow	semi-determinate	29[b]
ICPL 87119-8	Yellow	determinate	41[a]
ICPL 87034	Yellow	determinate	30[b]
ICPL 85063-19	Yellow	determinate	28[bc]
Seng- ewan	Yellow	determinate	46[a]
CV (%)			11.90

Means with the same letter are not significantly different at 5% level by DMRT.

Pod Characters

Pod Color

Most of the accessions have mixed green and purple pod color while accessions ICPL 7035-9 and ICPL 20092-6 exhibited dark purple and green color.

Pod Form

All accessions have cylindrical pods except for ICPL 7035-9 with flat pod.

Pod Hairiness

All of the accessions have pubescent pod.

Pod Length, Width and Bearing Length

Significant differences were observed among the accessions in terms of pod length, width and bearing length (Table 4). “Seng-ewan” produced the longest pods. The shortest pods were obtained from ICPL 87034 and ICPL 85063-19. On pod width, “Seng-ewan” had the widest pods which were comparable with the pods of ICPL 7035-9 while the narrowest pods were observed from the other accessions (Table 4), “Seng-ewan” has the longest pod bearing length which measures 69 cm while the rest of the accessions measured from 18 – 35.67 cm. Figure 1 presents the pods from eight pigeon pea accessions.

Table 4. Pod length, pod width and pod bearing length of eight pigeon pea accession

ACCESSION	POD LENGTH (cm)	POD WIDTH (cm)	POD BEARING LENGTH (cm)
ICPL 7035-9	7.57[b]	1.10[a]	32.67[b]
ICPL 8863-10	5.73[d]	0.90[b]	20.33[b]
ICPL 88039	6.50[c]	0.93[b]	33.67[b]
ICPL 20092-6	5.57[d]	0.833[b]	18.00[b]
ICPL 87119-8	6.43[c]	0.90[b]	22.00[b]
ICPL 87034	5.27[d]	0.90[b]	34.33[b]
ICPL 85063-19	5.63[d]	0.97[b]	35.67[b]
Seng- ewan	8.60[a]	1.20[a]	69.00[a]
CV (%)	4.80	7.27	39.31

Means with the same letter are not significantly different at 5% level by DMRT.

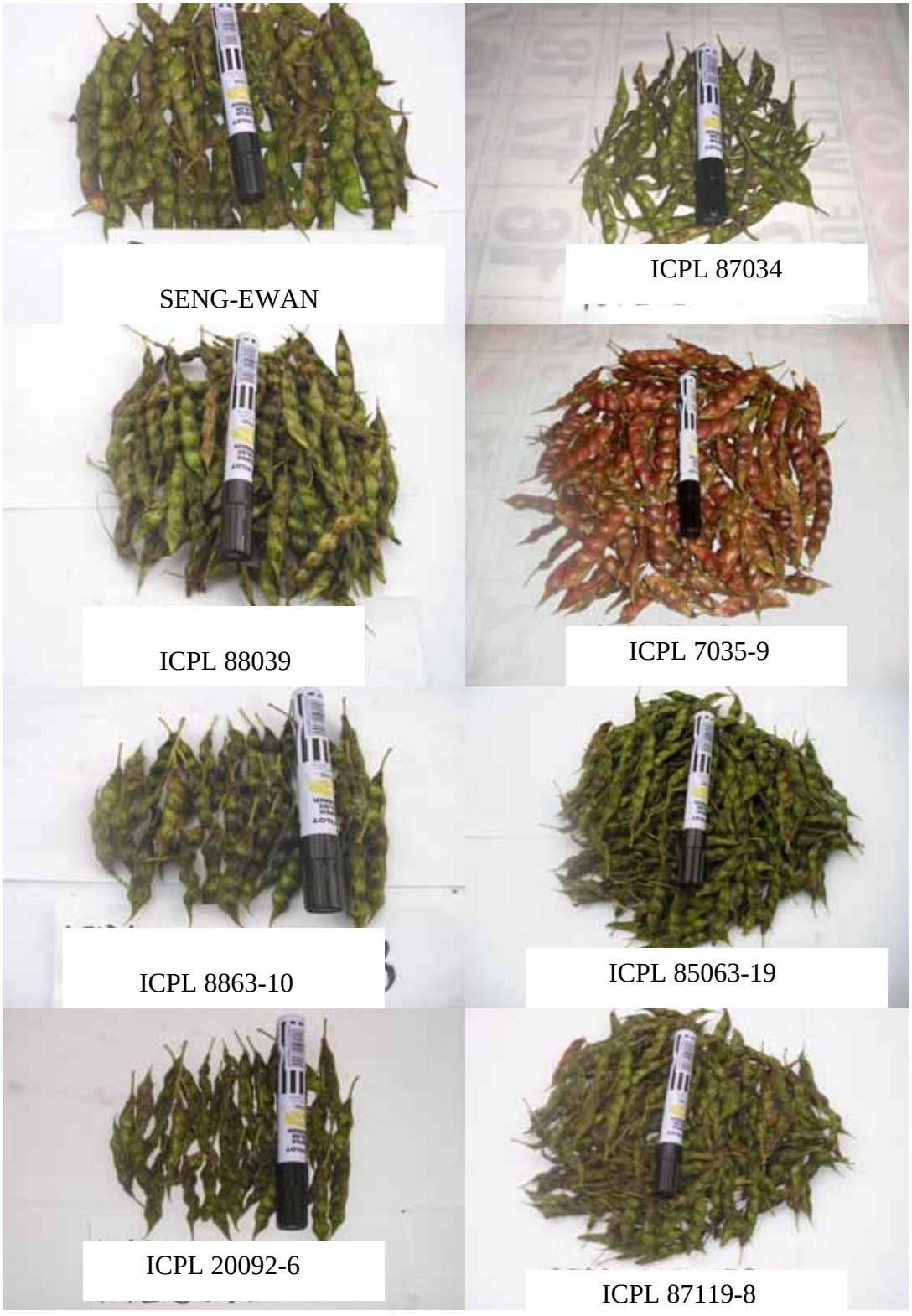

Fig.1. Harvested pods from eight pigeon pea accessions.

Seed Characters

Number of Seeds per Pod

Statistical analysis did not reveal any significant differences among the accessions for the number of seeds per pod. Numerically, more seeds were obtained from "Seng-ewan" (Table 5).

Seed Color Pattern

ICPL 7035-9 has mottled and speckled seed; ICPL 20092-6 has speckled seed and ICPL 8863-10, ICPL 88039, "Seng-ewan", ICPL 87119-8, ICPL 87034 and ICPL 85063-10 have plain seeds.

Weight of 100 Seeds

"Seng-ewan" significantly produced the heaviest weight with 14.60 g, ICPL 7035-9 and ICPL 8863-10 with 10.53 g but comparable with ICPL 88039, ICPL 87119-8 and ICPL 87034. Accession ICPL 20092-6 produced the lightest seeds (Table 5). Differences in seed weights could be attributed to the genetic constitution of the accessions and the size of the seeds.

Seed Shape

Most of the accessions exhibited squarish seed shape. Globular seed shapes were observed from ICPL 7035-9, "Seng-ewan" and ICPL 20092-6, while ICPL 87119-8 exhibited an oval seed.

Base Seed Color

All of the accessions exhibited dark purple base color.

Table 5. Seed characters of eight pigeon pea accessions

ACCESSIONS	NUMBER OF SEEDS PER POD	WEIGTH OF 100 SEEDS (g)	SEED COLOR PATTERN	SEED SHAPE
ICPL 7035-9	4	13.50[b]	mottled and speckled	globular
ICPL 8863-10	4	10.53[c]	plain	squarish
ICPL 88039	4	10.47[cd]	plain	squarish
ICPL 20092-6	4	9.30[e]	speckled	globular
ICPL 87119-8	4	10.07[cd]	plain	oval
ICPL 87034	4	10.30[cd]	plain	Squarish
ICPL 85063-19	4	9.97[d]	plain	Squarish
Seng- ewan	4	14.60[a]	plain	Globular
CV (%)	11.3	2.46		

Means with the same letter are not significantly different at 5% level by DMRT.

Green-Shelled Seed Yield

Table 6 shows the green-seed yield of eight pigeon pea accessions. Highly significant differences were observed. "Seng-ewan" produced the heaviest weight while the lightest was taken from ICPL 88039.

Dry Seed Yield

The dry seed yield of eight pigeon pea accessions studied revealed that "Seng-ewan" produced the heaviest seed followed by ICPL 87119-8.

Table 6. Green-shelled seed and dry seed yield of eight pigeon pea accessions

ACCESSION	GREEN-SHELLED SEEDYIELD (g)	DRY SEED YIELD (g)
ICPL 7035-9	56.17[b]	27.30[b]
ICPL 8863-10	58.07[b]	34.33[b]
ICPL 88039	35.27[b]	26.73[b]
ICPL 20092-6	42.33[b]	27.83[b]
ICPL 87119-8	115.90[b]	56.50[a]
ICPL 87034	35.77[b]	29.10[b]
ICPL 85063-19	39.47[b]	32.70[b]
Seng- ewan	255.03[a]	61.20[a]
CV (%)	74.11	27.89

Means with the same letter are not significantly different at 5% level by DMRT.

Fig.2. Green-shelled seeds harvested from eight pigeon pea accessions

Table 7. Harvest index of eight pigeon pea accessions

ACCESSION	HARVEST INDEX
ICPL 7035-9	0.0233[ab]
ICPL 8863-10	0.0200[abc]
ICPL 88039	0.0200[abc]
ICPL 20092-6	0.0167[bcd]
ICPL 87119-8	0.0233[ab]
ICPL 87034	0.0133[cd]
ICPL 85063-19	0.0100[d]
Seng- ewan	0.0267[a]
CV (%)	23.12

Means with the same letter are not significantly different at 5% level by DMRT.

Harvest Index

Table shows the harvest index of eight pigeon pea accessions. Highly significant differences were observed. "Seng-ewan" obtained the highest harvest index but comparable with ICPL 87119-8, ICPL 7035-9, ICPL 88039 and ICPL 8863-10. Lowest harvest index was obtained from ICPL 85063-19 which is comparable with ICPL 87034 and ICPL 20092-6.

Reaction to Pod Borer

Among the eight accessions evaluated at 120 DAP, ICPL 8863-10, 88039, "Seng-ewan", 20092-6 and 87034 have mild resistance to pod borer. The rest of the accessions have moderate resistance. Pod borer infestations at 135 DAP have mild resistance. At

150 DAP, no infestation was observed from Seng-ewan, ICPL 20092-6 and ICPL 87119-8, ICPL 8863-10, ICPL 88039, ICPL 87034, ICPL 85063-19 have mild resistance.

Reaction to Bean Rust

As shown in the Table 9, bean rust was observed at 90, 120 and 150 DAP. At 90 DAP mild resistance was observed from the accessions. Moderate resistance was observed at 120 DAP. ICPL 8863-10 and ICPL 87034 were observed to be susceptible to bean rust at 150 DAP while the rest of the accessions were moderately resistant.

Table 8. Reaction to Pod Borer

ACCESSION	REACTION		
	120 DAP	135 DAP	150 DAP
ICPL 7035-9	3	2	2
ICPL 8863-10	2	2	2
ICPL 88039	2	2	2
ICPL 20092-6	3	2	1
ICPL 87119-8	2	2	1
ICPL 87034	2	2	2
ICPL 85063-19	3	2	2
Seng- ewan	2	2	1

Rating scale: 1- Highly resistant 2-Mild resistant 3- Moderate resistant
4 – Susceptible 5- Very susceptible

Table 9. Reaction to Bean rust

ACCESSION	REACTION		
	90 DAP	120 DAP	150 DAP
ICPL 7035-9	1	3	3
ICPL 8863-10	1	3	4
ICPL 88039	1	3	3
ICPL 20092-6	1	3	3
ICPL 87119-8	1	3	3
ICPL 87034	1	3	3
ICPL 85063-19	1	3	3
Seng- ewan	1	3	3

Rating scale: 1- Highly resistant 2-Mild resistant 3- Moderate resistant
4 - Susceptible 5- Very susceptible

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

The study was conducted to morphologically characterize pigeon pea accessions; to evaluate the yield; and to identify the best performing pigeon pea accessions under Datakan, Kapangan, Benguet.

Highly significant differences were observed on days of emergence to flowering, pod setting, seed filling, initial and final plant height, weight of 100 seeds, green seed yield and dry seed yield.

"Seng- ewan" produced the highest green shelled seeds and dry seed yield and weight of 100 seeds. Leaves of each accession were observed to be elliptic to broad elliptic leaf shape. All accessions have pubescent leaf. "Seng-ewan" was the tallest at 35 and 150 DAP producing highest number of secondary branches. "Seng-ewan" and ICPL 87119-8 had indeterminate stem thickness.

Most pigeon pea accessions have determinate flowering pattern with predominantly yellow flower. These have medium amount of streaks. Highest raceme number was observed from "Seng-ewan".

Pod color of pigeon pea varied from dark purple to mixed green and purple to green. "Seng-ewan" had the longest and widest pods while ICPL 88039 had the shortest and ICPL 20092-6 the narrowest pods. "Seng-ewan" had the highest pod bearing length. Most of the accessions have cylindrical pod form, while ICPL 7035-9 has flat pod. All of the accessions exhibited pubescent pods.

As to the computed harvest index, significant differences existed among the accessions.

On the occurrence of insects and diseases, pigeon pea accessions were rated as moderately to mild resistant to pod borer. On Bean rust resistance, accessions were rated high resistant to susceptible.

Conclusions

The pigeon pea accessions differ for some morphological characters such as pod width, pod length and raceme number. All the accessions have mild resistance to pod borer while moderate resistance to bean rust. “Seng-ewan” is the highest yielding accession in terms of green-shelled seeds and dry seed yield. ICPL 87119-8 also produced heavy seeds.

Recommendation

Based on the results, variety “Seng-ewan” and ICPL 87119-8 are recommended for green-shelled and dry-shelled seed yield production at Datakan, Kapangan, Benguet.

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APPENDICES

Appendix Table 1. Days of emergence

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	5	6	5	16	5.3
ICPL 8863-10	5	5	4	14	4.7
ICPL 88039	6	6	4	16	5.3
SENG-EWAN	5	6	5	16	5.3
ICPL 20092-6	6	6	5	17	5.7
ICPL 87119-8	6	5	6	17	5.7
ICPL 87034	4	5	5	14	4.7
ICPL 85063-19	6	5	6	17	5.7
TOTAL	43	44	40	127	5.3

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	3.6250	0.5179	1.16^{ns}	2.77	4.28
Treatment	7	1.0833	0.5417			
Error	14	6.2500	0.4464			
TOTAL	23	10.9583				

ns- not Significant

Coefficient of Variance = 12.63%
Standard Error = 0.3858

Appendix Table 2. Number of days from emergence to pod setting

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	126	126	126	378	126
ICPL 8863-10	137	135	136	408	136
ICPL 88039	128	127	125	380	127
SENG-EWAN	144	143	143	430	143
ICPL 20092-6	144	144	144	432	144
ICPL 87119-8	129	127	127	383	128
ICPL 87034	140	139	138	417	139
ICPL 85063-19	131	131	130	392	131
TOTAL					

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	6.5833	3.2917	379.62**	2.77	4.28
Treatment	7	1154.6667	164.9524			
Error	14	6.0833	0.4345			
TOTAL	23	1167.3333				

** - highly significant

Coefficient of variance = 0.49%
Standard error = 0.3806

Appendix Table 3. Number of days from emergence to flowering

	REPLICATION				
ACCESSION	I	I I	I I I	TOTAL	MEAN
ICPL 7035-9	116	115	116	347	115.6
ICPL 8863-10	128	126	125	379	126.3
ICPL 88039	118	118	116	352	117.3
"Seng ewan"	137	136	136	409	136.3
ICPL 87034	119	117	117	353	117.6
ICPL 87119-8	134	132	132	398	132.6
ICPL 85063-19	122	120	119	361	120.3
ICPL 20092-6	136	136	136	408	136.0
TOTAL	1010	1000	997	3007	125.3

ANALYSIS OF VARIANCE

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	Computed F	Tabulated F 0.05	0.01
Replication	2	11.5833	5.7917	449.59**	2.77	4.28
Treatment	7	1592.2917	227.4702			
Error	14	7.0833	0.5060			
TOTAL	23	1610.9583				

**- highly significant

Coefficient of Variance = 0.57%
Standard Error = 0.4107

Appendix Table 4. Number of days from emergence to seed filling

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	134	133	133	400	133.33
ICPL 8863-10	145	144	145	434	144.67
ICPL 88039	135	135	135	405	135.00
SENG-EWAN	149	149	149	447	149.00
ICPL 20092-6	150	150	150	450	150.00
ICPL 87119-8	137	136	136	409	136.33
ICPL 87034	146	146	146	438	146.00
ICPL 85063-19	138	137	138	413	137.67
TOTAL	1134	1130	1132	3396	141.50

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	1.0000	0.5000	1112.80**	2.76	4.28
Treatment	7	927.3333	132.4762			
Error	14	1.6667	0.1190			
TOTAL	23	930.0000				

**- highly significant

Coefficient of Variance = 0.24%
Standard Error = 0.1992

Appendix Table 5. Initial Plant height (cm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	7.9	7.9	8.1	23.9	8.0
ICPL 8863-10	7.6	7.9	8.2	23.7	7.9
ICPL 88039	7.2	7.3	7.3	21.8	7.3
SENG-EWAN	10.3	10.2	10.0	30.5	10.2
ICPL 20092-6	5.4	5.9	5.6	16.9	5.6
ICPL 87119-8	7.4	7.0	7.6	22.0	7.3
ICPL 87034	6.2	6.1	6.5	18.8	6.3
ICPL 85063-19	6.9	7.1	7.0	21.0	7.0
TOTAL	58.9	59.4	60.3	178.6	7.4

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.1258	0.0629	138.58**	2.77	4.28
Treatment	7	38.3983	5.4855			
Error	14	0.5542	0.0396			
TOTAL	23	39.0783				

**- highly significant

Coefficient of Variance = 2.67%
Standard Error = 0.1149

Appendix Table 6. Final plant height (cm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	32.3	86.6	50.0	168.9	56.3
ICPL 8863-10	75.0	81.3	83.6	239.9	80.0
ICPL 88039	51.6	72.3	72.6	196.5	65.5
SENG-EWAN	104.0	129.3	108.0	341.3	113.8
ICPL 20092-6	48.6	57.6	63.3	169.5	56.5
ICPL 87119-8	50.0	101.3	60.0	211.3	70.4
ICPL 87034	86.0	89.6	98.3	273.9	91.3
ICPL 85063-19	44.3	87.0	100.6	231.9	77.3
TOTAL	491.8	705.0	636.4	1833.2	76.4

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	2961.2233	1480.6117	5.82**	2.77	4.28
Treatment	7	7758.7133	1108.3876			
Error	14	2666.9367	190.4955			
TOTAL	23	13386.8733				

**-highly significant

Coefficient of variance =18.07%

Standard error =7.9686

Appendix Table 7. Number of secondary branches

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	3	5	3	11	4
ICPL 8863-10	3	5	3	11	4
ICPL 88039	3	8	3	14	5
SENG-EWAN	4	7	7	18	6
ICPL 20092-6	6	10	7	23	8
ICPL 87119-8	4	6	3	13	4
ICPL 87034	5	6	5	16	5
ICPL 85063-19	3	5	3	11	4
TOTAL	31	52	34	117	4.9

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	32.2500	16.1250	6.76**	2.77	4.28
Treatment	7	41.9583	5.9940			
Error	14	12.4167	0.8869			
TOTAL	23	86.6250				

**-highly significant

Coefficient of variance =19.32%
Standard error=0.5437

Appendix Table 8.Stem thickness (mm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	3	5	3	11	3.67
ICPL 8863-10	3	3	3	9	3
ICPL 88039	3	5	3	11	3.67
SENG-EWAN	5	5	5	15	5.0
ICPL 20092-6	3	5	5	13	4.33
ICPL 87119-8	3	5	5	13	4.33
ICPL 87034	5	5	3	13	4.33
ICPL 85063-19	3	5	5	13	4.33
TOTAL	28	38	32	98	4.08

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	6.3333	3.1667	1.52ns	2.76	4.28
Treatment	7	7.3333	1.0476			
Error	14	9.6667	0.6905			
TOTAL	23	23.3333				

ns – not significant

Coefficient of variance =19.94 %
Standard error = 0.4797

Appendix Table 9. Raceme number

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	19	22	16	57	19
ICPL 8863-10	25	26	16	67	22
ICPL 88039	28	39	25	92	31
SENG-EWAN	51	46	41	138	46
ICPL 20092-6	27	35	27	89	30
ICPL 87119-8	36	47	40	123	41
ICPL 87034	35	29	26	90	30
ICPL 85063-19	30	32	22	84	28
TOTAL	241	282	213	740	30.83

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	251.5833	125.7917	17.70**	2.76	4.28
Treatment	7	1667.3333	238.1905			
Error	14	188.4167	13.4583			
TOTAL	23	2107.3333				

**- highly significant

Coefficient of variance = 11.90 %
Standard error =2.1180

Appendix Table 10. Pod length (cm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	7.7	7.8	7.2	22.7	7.6
ICPL 8863-10	5.7	5.7	5.8	17.2	5.7
ICPL 88039	6.5	6.7	6.3	19.5	6.5
SENG-EWAN	8.2	9.1	8.5	25.8	8.6
ICPL 20092-6	5.4	5.6	5.7	16.7	5.6
ICPL 87119-8	7.0	6.0	6.3	19.3	6.4
ICPL 87034	5.2	5.2	5.4	15.8	5.3
ICPL 85063-19	5.5	5.6	5.8	16.9	5.6
TOTAL	51.2	51.7	51.0	153.9	6.4

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.0325	0.0163	41.68**	2.77	4.28
Treatment	7	27.6663	3.9523			
Error	14	1.3275	0.0948			
TOTAL	23	29.0263				

** - highly significant

Coefficient of Variance = 4.80%
Standard error = 0.1778

Appendix Table 11. Pod width (cm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	1.2	1.2	0.9	3.3	1.10
ICPL 8863-10	0.9	0.9	0.9	2.7	0.90
ICPL 88039	1.0	0.9	0.9	2.8	0.93
SENG-EWAN	1.2	1.2	1.2	3.6	1.20
ICPL 20092-6	0.9	0.8	0.8	2.5	0.83
ICPL 87119-8	0.9	0.9	0.9	2.7	0.90
ICPL 87034	1.0	0.9	1.0	2.9	0.97
ICPL 85063-19	1.0	0.9	1.0	2.9	0.97
TOTAL	8.1	7.7	7.4	23.2	0.97

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.0308	0.0154	9.06**	2.76	4.28
Treatment	7	0.3133	0.0448			
Error	14	0.0692	0.0049			
TOTAL	23	0.4133				

** - highly significant

Coefficient of Variance = 7.27%
Standard error = 0.0406

Appendix Table 12. Pod bearing length (cm)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	20	51	27	98	32.67
ICPL 8863-10	13	17	31	61	20.33
ICPL 88039	23	46	32	101	33.67
SENG-EWAN	68	98	41	207	69.00
ICPL 20092-6	17	17	20	54	18.0
ICPL 87119-8	23	18	25	66	22.0
ICPL 87034	26	45	32	103	34.33
ICPL 85063-19	19	38	50	107	35.67
TOTAL	209	330	258	797	33.21

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	926.0833	463.0417	4.56**	2.76	4.28
Treatment	7	5434.6250	776.3750			
Error	14	2385.2500	170.3750			
TOTAL	23	8745.9583				

** - highly significant

Coefficient of Variance = 39.31%
Standard error = 7.5360

Appendix Table 13. Seeds per pod

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	5	4	4	13	4
ICPL 8863-10	4	5	4	13	4
ICPL 88039	5	3	4	12	4
SENG-EWAN	6	5	5	16	5
ICPL 20092-6	4	4	4	12	4
ICPL 87119-8	4	4	4	12	4
ICPL 87034	5	4	4	13	4
ICPL 85063-19	4	4	4	12	4
TOTAL	37	33	33	103	4.29

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	1.3333	0.6131	2.58^{ns}	2.76	4.28
Treatment	7	4.2917	0.6131			
Error	14	3.3333	0.2381			
TOTAL	23	8.9583				

^{ns} – not significant

Coefficient of variance = 11.37%
Standard error = 0.2817

Appendix Table 14. Weight of 100 seeds (g)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	13.7	13.6	13.2	40.5	13.50
ICPL 8863-10	10.3	10.8	10.5	31.6	10.53
ICPL 88039	10.4	10.2	10.8	31.6	10.53
SENG-EWAN	14.6	14.3	14.9	43.8	14.60
ICPL 20092-6	9.3	9.1	9.5	27.9	9.30
ICPL 87119-8	9.8	10.4	10.0	30.9	10.30
ICPL 87034	10.0	10.6	10.3	30.9	10.30
ICPL 85063-19	9.7	10.2	10.0	29.9	9.97
TOTAL	87.8	89.2	89.2	266.2	11.09

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.1633	0.0817	143.56**	2.76	4.28
Treatment	7	74.8917	10.6988			
Error	14	1.0433	0.0745			
TOTAL	3	76.0983				

** - higly significant

Coefficient of Variance = 2.46%
Standard error = 0.1576

Appendix Table 15. Green shelled seed yield (g)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	54.1	54.7	59.7	168.5	56.17
ICPL 8863-10	59.7	58.9	55.6	174.2	58.07
ICPL 88039	52.5	22.4	30.9	105.8	35.27
SENG-EWAN	321.7	367.4	76.0	765.1	255.03
ICPL 20092-6	3.3	32.5	71.2	127.0	42.33
ICPL 87119-8	86.8	133.4	127.5	347.7	115.90
ICPL 87034	45.8	29.9	31.6	107.3	35.77
ICPL 85063-19	24.4	44.3	49.7	118.4	39.47
TOTAL	668.3	743.5	502.2	1914.0	79.75

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	3811.2475	1905.6238	4.91**	2.76	4.28
Treatment	7	119980.3933	17140.0562			
Error	14	48909.7592	3493.5542			
TOTAL	23	172701.4000				

** - highly significant

Coefficient of Variance = 74.11%
Standard error = 34.1250

Appendix Table 16. Dry seed yield (g)

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	27.4	27.1	27.4	81.9	27.30
ICPL 8863-10	34.3	37.7	31.0	103.0	34.33
ICPL 88039	40.8	15.8	23.6	80.2	26.73
SENG-EWAN	73.8	68.7	41.1	183.6	61.20
ICPL 20092-6	24.7	20.1	38.7	85.5	27.83
ICPL 87119-8	57.5	49.1	62.9	169.5	56.50
ICPL 87034	34.1	26.3	26.9	87.3	29.10
ICPL 85063-19	21.5	44.4	32.2	98.1	32.70
TOTAL	314.1	289.2	283.8	887.1	36.96

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	65.3025	32.6513	5.39**	2.76	4.28
Treatment	7	4012.2363	573.1766			
Error	14	1488.1375	106.2955			
TOTAL	23	5565.6763				

** - highly significant

Coefficient of Variance = 27.89%
Standard error = 5.955

Appendix Table 17. Harvest Index

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	0.03	0.02	0.02	0.07	0.023
ICPL 8863-10	0.02	0.02	0.02	0.06	0.020
ICPL 88039	0.02	0.02	0.02	0.06	0.020
SENG-EWAN	0.03	0.02	0.03	0.08	0.027
ICPL 20092-6	0.02	0.02	0.01	0.05	0.027
ICPL 87119-8	0.03	0.02	0.02	0.07	0.023
ICPL 87034	0.01	0.01	0.02	0.04	0.013
ICPL 85063-19	0.01	0.01	0.01	0.03	0.010
TOTAL	0.16	0.14	0.15	0.46	0.02

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.00010	0.00005	4.73**	2.76	4.28
Treatment	7	0.00070	0.00010			
Error	14	0.00030	0.00002			
TOTAL	23	0.00100				

** - highly significant

Coefficient of variance = 23.12%
Standard error = 0.0026

Appendix Table 18. Reaction to pod borer at 120 DAP

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	3	3	3	9	3
ICPL 8863-10	2	2	2	7	2
ICPL 88039	2	3	2	7	2
SENG-EWAN	2	2	2	6	2
ICPL 20092-6	3	2	3	8	3
ICPL 87119-8	2	2	2	6	2
ICPL 87034	2	2	2	6	2
ICPL 85063-19	3	2	3	8	3
TOTAL	19	15	27	57	19

Appendix Table 19. Reaction of pod borer at 150 DAP

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	2	3	2	7	2
ICPL 8863-10	1	2	2	5	2
ICPL 88039	2	1	2	5	2
SENG-EWAN	1	1	1	3	1
ICPL 20092-6	1	1	2	4	1
ICPL 87119-8	1	1	2	4	1
ICPL 87034	2	2	2	6	2
ICPL 85063-19	2	1	2	5	2
TOTAL	12	12	15	39	2

Appendix Table 20. Reaction to bean rust at 150 DAP

ACCESSION	REPLICATION				
	I	II	III	TOTAL	MEAN
ICPL 7035-9	3	3	3	9	3
ICPL 8863-10	4	4	3	11	4
ICPL 88039	3	2	3	8	3
SENG-EWAN	3	3	3	9	3
ICPL 20092-6	4	3	3	10	3
ICPL 87119-8	3	3	3	9	3
ICPL 87034	4	4	3	11	4
ICPL 85063-19	4	3	3	10	3
TOTAL	28	18	24	77	3