

BIBLIOGRAPHY

BENIASAN, EFREN T. OCTOBER 2010. Pilot Testing of Garden Pea (*Pisum sativum L.*) Lines Under Topdac, Atok, Benguet Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

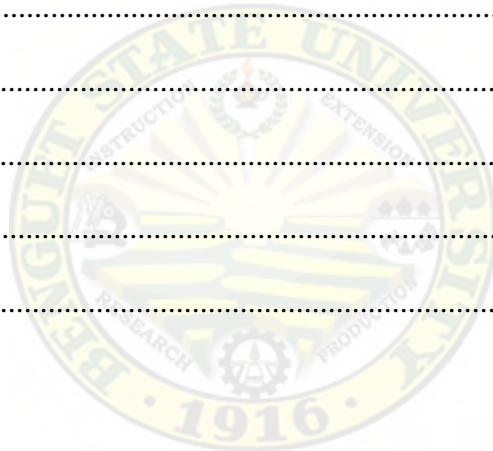
Several garden pea lines were evaluated under Topdac, Atok, Benguet condition as to their growth and yield performance in October to December (early dry and cool season).

Observation shows that growth did not differ among the lines tested. Although not significant, yield was higher in CGP 110 at 16.31 t/ha although having smaller pods and in CGP 18A at 15.24 t/ha having bigger pods. These lines have moderate resistance to leaf miner and powdery mildew, are preferred by farmers in terms of better pod shape, size, and color, and from which high return on investment was obtained.

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INTRODUCTION

Atok is one of the 13 municipalities of Benguet producing tons of temperate vegetable due to its favorable climate. There are vegetables being grown in this place but legumes are rarely grown by farmers for the reason of unavailability of seeds and good varieties. Garden pea is cool climate requiring crop and Atok is a suitable growing area.

Pilot testing is an innovative work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, installing new processes, system and services and improving substantially those already produced or installed (IPB-BSU).

The selection of the best garden pea lines for farmers to grow will enable them to produce high yield and quality as well as improve farm income.

The objectives of the study were to:

1. Evaluate the growth and yield performance of garden pea lines produced by the Institute of Plant Breeding-Benguet State University (IPB-BSU) Highland Crops Research Station (HCRS) in a farmer's field and
2. Identify the lines best adapted in the locality.

The study was conducted in Nalseb, Topdac, Atok, Benguet from October to December 2009.



REVIEW OF LITERATURE

Description of the Garden Pea

Garden peas differ from beans in that the stems are hollow and the leaves are pinnately compound with one, two, or three pairs of leaflets and a branched terminal tendrils and large stipules; the flowers are born singly or in pairs on long stalks; the pods are non constricted, and the seed is round and either smooth or wrinkled when dry. Edmund (1964). Similarly, Hughes (1930) reported that the pods of garden peas are about three inches long, each containing five to nine round seed. The seed are generally brown. Seed of field peas are generally smooth and those of garden peas wrinkled at maturity.

Chapman (1976) stated that the pea plant is an herbaceous annual. Stems range from 2 to 4 feet (50.8-101.6 cm) in length and are quite succulent. Leaves are typically pinnately compound, but the apical leaflet is modified into a split or double tendrils. Flowers are commonly borne in single leaf axils. In addition, Delorit (1974) stated that the field peas have been classified as a species different from garden and canning peas, but they resemble each other rather closely. Some garden and canning varieties are sweeter and more wrinkled. Peas are annual, leguminous plants with long weak, herbaceous stems. The stems maybe 24 to 48 inches long, but the plants usually do not stand that tall because of lodging. The pale green leaves consist of one to three pairs of leaflet with a terminal tendrils. The blossoms are reddish-purple or white. The pods (ovaries) usually contain four to nine seeds (ovules).



Importance of Garden Pea

Garden Peas are harvested for seed or edible peas when most of the pods are ripe and the seed is hard. Many of the dry edible peas are marketed as split peas for use in soups. Dry pea seeds and the by-products from pea seed processing also are used in mixed livestock feeds and in pigeon feeds (Delorit, 1974). Similarly, Chapman (1976) reported that field peas are grown primarily as a green manure crop. When the crop is harvested for seed, it is most commonly used as split peas in various types of soups. Field peas are high in protein (as much as 24 percent) and may become increasingly important as both a food and a feed crop in the future. In addition, Tindall (1983) reported that the protein content of immature seeds varies from 3.1-7.2%, that of young pods 2.6-3.1% and mature peas about 22%.

Soil and Climatic Requirements of Garden Pea

Pea is a cool season crop and thrives best when the weather is cool and when ample moisture is available. The young plants will tolerate considerable colds and light frosts but the flower and green pods are often injured by heavy frosts. If the crop is planted late, maturity takes place when the temperatures are too high for optimum growth and yield (Ware, 1937).

Tindall (1983) stated that most cultivars require a relatively cool humid climate with temperature in the range 13-18 degrees Celsius and are, therefore, only suitable for cultivation at altitudes above 1200-1400m since high temperature affect pollination. Seeds have a minimum soil temperature requirement of about 10 degrees Celsius. In addition, Delorit (1974) reported that garden peas grow best on fertile, well lined soils that have good drainages.



Heriteau (1975) reported that peas leave a supply of nitrogen in the soil so they do not need a heavy supply of nutrient, therefore fertilize with a low nitrogen fertilizer.

Garden pea is a crop that is difficult to grow in warm places since this crop thrives best in relatively cool places. The growth is generally affected by temperature, humidity, and soil conditions. Different varieties may respond differently to the climate, which involve temperature, moisture, and light (Ware and Swaider, 2002).

This crop grows best in soil that is friable, fertile, well-drained, and free from nematodes and fungus diseases. Garden pea requires a pH of 5.5-6.0 (Purseglove, 1972).

Varietal Selection

In the highlands, leguminous crops are planted at the end of the rainy season, starting from October and extended to December. Garden peas are harvested when the pods are fully green and well developed but still tender. The seeds should be near full size and should not have begun to harden. Pea pods intended for dry pea or seed should be harvested when they start to yellow or begin to dry up (Ware and Swaider, 2002).

Varieties to be selected should be high-yielding, resistant to pest and diseases, early maturing and these traits would make the possible growing of the crop less expensive and more productive. More over choosing the right variety will minimize problems associated with water and fertilizer management so that high yield will be obtained. Growing the variety may mean crop failure due to low yield and pest infestation. Yield performance of any variety is affected by environmental conditions like soil condition, climate and incidence of pest and diseases (PCARRD, 1989).



Bautista and Mabesa (1997) mentioned that choosing the right variety will minimize the problem associated with water and fertilizer management so that high yield will be obtained.

Ware (1975) stated that in selecting garden pea varieties, one must consider the resistance to pest and diseases to obtain high yield. In addition, Heritaeu (1975) stated that one thing to consider in selecting seeds includes growth habit.



MATERIALS AND METHODS

The materials used in the study were seeds different lines of garden pea, garden tools, insecticide, fungicide, fertilizers, sprinkler, record book, ruler, meter stick, and a calculator.

An area of 90 sq. m. was prepared for the study. The area was divided into three blocks representing the replications and each block was subdivided into six plots measuring 1m x 5m each representing the garden pea lines as treatments. The treatments were laid out in a Randomized Complete Block Design (RCBD) and represented as follows.

<u>Code</u>	<u>Garden Pea lines</u>
L ₁	CGP 13
L ₂	CGP 110
L ₃	CGP 18A (Check)
L ₄	CGP 34
L ₅	CGP 59
L ₆	CLG (Local Check)

Two furrows spaced 15 cm apart were made in each plot afterwhich two seeds were sown in the furrow 12 cm apart. All other practices like fertilizer application, irrigation, pest control, cultivation and training were employed to every treatment plot.



Data Gathered

The data gathered were as follows:

A. Growth and Development Stages

1. Number of days from sowing to emergence. This was obtained by counting the number of days from sowing to emergence.

2. 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 in a plot had at least two fully opened flowers.

3. Number of days from emergence to last flowering. This was recorded by counting the number of days from emergence to last flowering when 50% of the plants in a plot had stopped flowering.

4. Number of days from flowering to pod setting. This was obtained by counting the number of days from flowering until the pods began to develop.

5. Number of days from flowering to first and last harvesting. This was recorded by counting the number of days from flowering to first and to last harvesting.

B. Leaf Characteristics

1. Leaflet length (cm). This was measured using a ruler from the base of the petiole to the leaf tip of the ten sample leaves per treatment at 35 days after planting.

2. Leaflet width (cm). The sample leaves used in measuring the leaflet length were used to measure the leaflet width. This was obtained by measuring from left to the right margin of the leaf.



C. Stem Characteristics

1. Plant height at 35 DAP and last harvest (cm). This was measured from the base of the plant at ground level to the tip of the youngest shoot using a meter stick from ten sample plants per treatment at 35 DAP and during the last harvest.

2. Number of nodes per plant. This was counted from the base of the plant to the tip of the main stem of ten sample plants per treatment during the last harvest.

3. Number of nodes bearing first flower cluster. This was recorded by counting the nodes from the base of the plant to the node bearing first flower cluster in five sample plants per treatment.

4. Number of nodes bearing first pod cluster. This was recorded by counting the nodes from the base of the plant to the node bearing the first pod cluster in five sample plants per treatment.

D. Flower Characteristics

1. Flower color. This was recorded when 50% of the plants per plot have fully opened flowers using color chart.

2. Number of flowers per cluster. The flowers per cluster were counted from ten samples per plot.

E. Pod Characteristics

1. Pod length (cm). This was obtained by measuring the length of ten sample pods per treatment from the base to the tip of the pod.

2. Pod width (cm). This was obtained by measuring the broadest part of the sample pods used in gathering pod length using foot rule.



3. Pod color. This was recorded as green, light green, yellow, dark green when the pods were fully developed.

F. Yield Characteristics

1. Weight of marketable pods (kg/1 x 5 m plot). This was recorded by weighing the marketable pods per plot from first to last harvest. Marketable pods were smooth, well formed pods, and free from damages.

2. Weight of non-marketable pods (kg/1 x 5 m plot). This was obtained by weighing non-marketable pods per plot. Non-marketable pods were over-matured, malformed and damaged by insect pests and diseases.

3. Total yield (kg/1 x 5 m plot). This was recorded by getting the total weight of marketable and non-marketable pods per plot.

4. Number of pod pickings. This was the total number of harvest from the first to the last picking.

5. Computed yield per hectare (t/ha). This was obtained by multiplying the yield per plot by 2000 which is the number of 1m x 5m plot per hectare.

G. Insect Pest and Disease Assessment

1. Rating on insect pest and disease damage. The insect pest damage and disease infection were recorded. The following subjective rating (Del-amen, 2009) was used:



<u>Scale</u>	<u>Description</u>	<u>Remarks</u>
1.0	No insect pest damage/infection	High resistance
2.0	1-25% of the total no. of plants per plot is damaged/infected, mild damage/infection	Mild resistance
3.0	26-50% of the total no. of plants per plot is damaged/infected, moderate damage/infection	Moderate resistance
4.0	51-75% of the total no. of plants per plot is damaged/infected, severe damage/infection	Susceptible
5.0	76-100% of the total no. of plants per plot is damaged/infected, severe damage/infection	Very susceptible

H. Farmers' Acceptability

Sensory evaluation of six lines of garden pea was done by the farmers in terms of growth, pod shape and size, pod color, and pod crunchiness as to whether they are liked, liked very much or disliked.

I. Return on Investment

This was computed by subtracting the total expenses per 5 m sq plot from the gross sale divided by total expenses times one hundred.

J. Documentation

The study was documented from the sowing of seeds to harvest evaluation as shown in figures 1 to 7.





Figure 1. Sowing of seeds



Figure 2. Field after sowing of seeds



Figure 3. Seedling emergence six days after planting



Figure 4. Training of plants with trellis



Figure 5 a. Garden pea lines CGP 13



Figure 5 b. CGP 110



Figure 5 c. CGP 18A



Figure 5 d. CGP 34

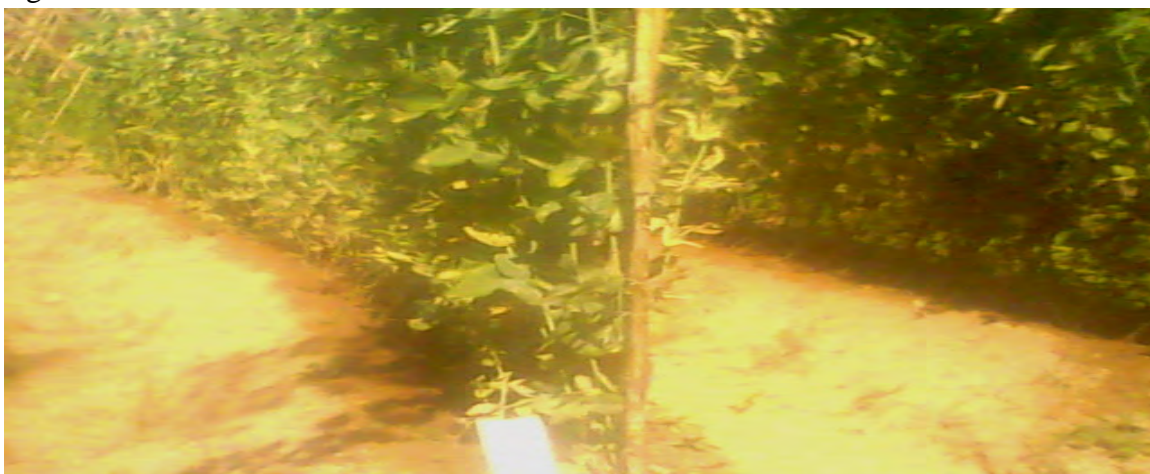


Figure 5 e. CGP 59



Figure 5 f. CLG



Figure 6. Garden pea lines at harvest stage



Figure 7 a. Evaluation of garden pea lines by farmers after harvest



Figure 7 b. Evaluation of garden pea lines by farmers after harvest

RESULTS AND DISCUSSION

Days to Emergence, Flowering, and Harvest

The number of days from sowing to emergence, emergence to flowering, flowering to pod set, and to harvest were not significantly different among the garden pea lines evaluated (Table 1).

Table 1. Days to emergence, flowering, pod set, and harvest

LINES	DAYS FROM SOWING TO SEEDLING EMERGENCE	DAYS FROM EMERGENCE TO		DAYS FROM FLOWERING TO		
		FIRST FLO- WERING	LAST FLO- WERING	POD SET	FIRST HARVEST	LAST HARVEST
CGP 13	6 ^a	36.33 ^a	66.67 ^a	2.33 ^a	6.67 ^a	38.00 ^a
CGP 110	6 ^a	36.00 ^a	67.33 ^a	2.33 ^a	6.33 ^a	38.67 ^a
CGP18A	6 ^a	36.67 ^a	66.33 ^a	2.00 ^a	6.0 ^a	37.00 ^a
CGP 34	6 ^a	37.3 ^a	67.00 ^a	2.33 ^a	6.67 ^a	37.67 ^a
CGP 59	6 ^a	37.33 ^a	66.33 ^a	2.33 ^a	6.67 ^a	37.67 _a
CLG	6 ^a	36.67 ^a	67.33 ^a	2.33 ^a	6.00 ^a	37.67 ^a
CV (%)	0	1.96	5.64	22.41	6.82	3.05

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



Leaf Characteristics

Leaflet length. CGP 18A significantly had the longest leaf as shown in Table 2.

Leaflet width. In terms of leaflet width, there were no significant differences observed among the lines (Table 2).

Plant Height

There were no significant differences in the plant height at 35 days after planting and last harvest (Table 3). However, CGP 18A was the tallest.

Table 2. Leaflet length and width

LINES	LEAFLET SIZE (cm)	
	LENGTH	WIDTH
CGP 13	3.57 ^b	2.62 ^a
CGP 110	3.59 ^b	2.65 ^a
CGP 18A	3.97 ^a	2.71 ^a
CGP 34	3.49 ^b	2.53 ^a
CGP 59	3.62 ^b	2.67 ^a
CLG	3.72 ^{ab}	2.79 ^a
CV (%)	3.86	3.15

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



Table 3. Plant height

LINES	PLANT HEIGHT (cm)	
	35 DAP	LAST HARVEST
CGP 13	39.43 ^a	151.47 ^a
CGP 110	35.23 ^a	135.27 ^a
CGP 18A	38.40 ^a	153.27 ^a
CGP 34	34.33 ^a	147.20 ^a
CGP 59	36.80 ^a	142.43 ^a
CLG	34.80 ^a	129.67 ^a
CV (%)	14.06	8.08

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

Number of Nodes Bearing First Flower
Cluster and Last Pod Cluster, Number of
Nodes per Plant and Number of Flowers per
Cluster

Table 4 shows that CLG significantly flowered earlier at fewer number of nodes. The number of nodes to last pod cluster, number of nodes per plant, and number of flowers per cluster did not significantly differ among the lines.

Flower Color

In terms of color, all the lines had violet flowers except CLG having white flowers.



Table 4. Number of nodes bearing the first flower cluster and last pod cluster, number of nodes per plant, and number of flowers per cluster

LINES	NUMBER OF NODES BEARING			
	FIRST FLOWER CLUSTER	LAST POD CLUSTER	NUMBER OF NODES PER PLANT	NUMBER OF FLOWERS PER CLUSTER
CGP 13	11.67 ^{ab}	29.67 ^a	34.00 ^a	2.00 ^a
CGP 110	12.67 ^a	28.33 ^a	34.33 ^a	1.33 ^a
CGP 18A	9.33 ^{ab}	30.33 ^a	34.67 ^a	1.67 ^a
CGP 34	13.00 ^a	30.33 ^a	34.33 ^a	2.00 ^a
CGP 59	10.00 ^{ab}	29.33 ^a	33.33 ^a	1.67 ^a
CLG	8.67 ^b	28.33 ^a	33.00 ^a	2.00 ^a
CV (%)	12.04	4.46	3.86	24.52

Means with the same letters are not significantly difference at 5% level by DMRT

Pod Length and Width

Table 5 shows that CGP 18A and CGP 13 significantly had the longest pod at around eight centimeters, while CGP 18A significantly had the widest pod at 1.77 cm.

Pod Color

In terms of pod color, all the lines had green pods except for CGP 110 and CLG having dark green and light green pods, respectively.



Table 5. Pod length and width

LINES	POD SIZE (cm)	
	POD LENGTH	POD WIDTH
CGP 13	8.23 ^a	1.50 ^b
CGP 110	7.10 ^{bc}	1.33 ^b
CGP18A	8.27 ^a	1.77 ^a
CGP 34	7.63 ^b	1.43 ^b
CGP 59	7.00 ^c	1.47 ^b
CLG	7.33 ^{bc}	1.43 ^b
CV (%)	2.95	6.00

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

Number of Pod Pickings

All the lines except CGP 18A and CGP 34 significantly had more number of pickings at seven times (Table 6).

Marketable, Non-marketable, and Total Yield

As shown in Table 6, no significant differences were observed in yield among the lines. However, higher marketable yield was obtained from CGP 110, CLG, CGP 34, and CGP 18A.

Computed Yield

In terms of computed yield per hectare, there were no significant differences among the lines. However, CGP 110, CGP 18A, and CLG had higher yield at around 15 to 16 t/ha (Table 7).



Table 6. Number of pod pickings, marketable, non-marketable, and total yield

LINES	NUMBER OF POD PICKINGS	YIELD (kg/1 x 5 m plot)		
		MARKETABLE	NON- MARKETABLE	TOTAL
CGP 13	7.00 ^a	6.21 ^a	0.39 ^a	6.60 ^a
CGP 110	7.00 ^a	7.78 ^a	0.48 ^a	8.16 ^a
CGP18A	6.00 ^b	7.11 ^a	0.51 ^a	7.62 ^a
CGP 34	6.00 ^b	7.15 ^a	0.38 ^a	7.41 ^a
CGP 59	6.67 ^a	5.86 ^a	0.38 ^a	6.16 ^a
CLG	7.00 ^a	7.19 ^a	0.42 ^a	7.60 ^a
CV (%)	3.77	15.04	12.74	14.18

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

Insect Pest and Disease Rating

There were no significant differences among the lines on insect infestation particularly leaf miner and disease infection of powdery mildew (Table 7). Nevertheless, all the lines except CGP 59 and CLG had moderate resistance to said pests.

Farmers' Acceptability

CGP 110 as well as CGP 18A were most liked by the farmers in terms of pod shape, size, and color (Table 8).



Table 7. Computed yield per hectare and insect pest and disease incidence rating

LINES	COMPUTED YIELD (kg/ha)	RATING	
		INSECT PEST (LEAF MINER INFESTATION)	DISEASE (POWDERY MILDEW INFECTION)
CGP 13	13195.00 ^a	3.33 ^a	3.33 ^a
CGP 110	16310.67 ^a	3.00 ^a	3.00 ^a
CGP18A	15238.00 ^a	3.33 ^a	3.33 ^a
CGP 34	14813.33 ^a	3.33 ^a	3.33 ^a
CGP 59	12322.67 ^a	4.00 ^a	4.00 ^a
CLG	15199.33 ^a	3.67 ^a	3.67 ^a
CV (%)	14.27	15.27	15.27

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

Table 8. Farmers' acceptability

LINES	POD			
	GROWTH	SHAPE AND SIZE	COLOR	CRUNCHINESS
CGP 13	Like	Like	Like	Like
CGP110	Like	Like Very Much	Like Very Much	Like
CGP 18A	Like	Like Very Much	Like	Like
CGP 34	Like	Like	Like	Like
CGP 59	Like	Like	Like	Like
CLG	Like	Dislike	Like	Dislike



Economic Analysis

Table 9 shows that the highest return on investment was obtained from CGP 110, CLG, CGP 34, and CGP 18A.

Table 9. Cost and return analysis (90 sq. m. area)

ITEM	LINES					
	CGP 13	CGP 110	CGP 18A	CGP 34	CGP 59	CLG
Yield(kg)	18.62	23.33	21.33	21.46	17.56	21.56
Sales(PhP)	1117.2	1399.8	1279.8	1287.6	1053.6	1293.6
Expenses						
Inputs:						
1. Seeds	41	41	41	41	41	41
2. Fertilizer	20	20	20	20	20	20
Labor Costs (PhP)						
3.Land						
Preparation	25	25	25	25	25	25
4. Planting	15	15	15	15	15	15
5. Irrigation	20	20	20	20	20	20
6. Weeding	15	15	15	15	15	15
7. Harvesting	15	15	15	15	15	15
8. Marketing	10	10	10	10	10	10
Total Expenses						
(PhP)	161	161	161	161	161	161
Net Income						
(PhP)	956.2	1238.8	1118.8	1126.6	892.6	1132.6
ROI(%)	593.91	769.44	694.90	699.75	544.40	703.47

Fresh pods were sold at PhP 60.00/ kg.



SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

Six garden pea lines developed by the Institute of Plant Breeding –Benguet State University (IPB-BSU) Highland Crops Research Station (HCRS) were tested in a farmer's field in Topdac, Atok, Benguet to determine adaptable line(s) in the locality.

There were no significant differences observed among the six garden pea lines on the duration to emergence, flowering, pod set, and harvest as well as on plant height.

CGP 18A significantly had the longest and widest pods. Yield did not significantly differ but higher marketable yield was obtained from CGP 110, CLG, CGP 34 and CGP 18A, and also from which higher return on investment was derived.

All the lines have moderate resistance to leaf miner and powdery mildew except CGP 59 and CLG which were susceptible.

Farmers' preferred CGP 110 and CGP 18A for having better pod shape, size and color.

Conclusion

Based on the results, CGP 110 and CGP 18A were observed to have better yield performance and acceptability in the site of the study. Potential lines for adaptation are CLG and CGP 34.

Recommendation

It is therefore recommended that the garden pea lines CGP 110 and CGP 18A be grown in Nalseb, Topdac, Atok and nearby localities. Other lines such as CLG and CGP 34 could be further evaluated for verification of their performance.



LITERATURE CITED

- BAUTISTA, O. K. and R.C. MABESA. 1997. Vegetable Production. College of Agriculture, UP at Los Baños, Laguna, Philippines. P. 320.
- CHAPMAN, H. 1976. Crop Production Principles and Practices. W.H. Freeman and Company. San Francisco. P. 371.
- DEL-AMEN, M. B. 2009. Growth, yield and farmers' acceptability of promising lines of garden pea in Madaymen, Kibungan, Benguet. BS Thesis. BSU, La Trinidad, Benguet. P. 4.
- DELORIT, J. R. 1974. Crop Production 4th Edition. New Jersey: Prentice-Hall. P. 432.
- EDMUND, J. B. 1964. Fundamentals of Horticulture. Tata McGraw hill Pub. Co. Ltd. P. 476.
- HERITEAU, J. 1975. Small Fruit and Vegetables Gardens. New York. P. 461.
- HUGHES, H. and HENSON. 1930. Crop Production Principles and Practices. New York. P. 365.
- PCARRD. 1989. Snap Bean Technoguide for the Highlands. First Edition. BSU, La Trinidad, Benguet. P. 5.
- PURSEGLOVE, J .W. 1972. Tropical Crops Dicotyledons, Copyright Longman Group Limited, United Kingdom. P. 312.
- TINDALL, H. D. 1983. Vegetables in the Tropics. Mc Millan Publishing Company. P. 284.
- WARE, G. W. 1975. Producing Vegetable Crops. Second Edition. The Interstate Printers and Publications, Inc. P. 379.
- WARE, G. W. 1937. Southern Vegetable Crops. New York: American Company. P. 306.
- WARE, G. W. and SWAIDER, J.M. 2002. Producing Vegetable Crops. The Interstate Printers and Publishers, Inc. USA. Pp. 427-439.



APPENDICES

Appendix Table 1. Number of days from sowing to emergence

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	6	6	6	18	6
CGP 110	6	6	6	18	6
CGP 18A	6	6	6	18	6
CGP 34	6	6	6	18	6
CGP 59	6	6	6	18	6
CLG	6	6	6	18	6

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0	0			
Treatment	5	0	0	0 ^{ns}	3.33	5.64
Error	10	0	0			
TOTAL	17	0				

^{ns} - Not significant

Coefficient of variation=0%



Appendix Table 2. Number of days from emergence to flowering

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	36	37	36	109	36.33
CGP110	36	36	36	108	36.00
CGP 18A	36	38	36	110	36.67
CGP 34	37	38	37	112	37.33
CGP 59	38	38	36	112	37.33
CLG	37	36	37	110	36.67

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	2.11	1.06			
Treatment	5	4.28	0.86	1.65 ^{ns}	3.33	5.64
Error	10	5.22	0.52			
TOTAL	17	11.61				

^{ns} - Not significant

Coefficient of variation=1.96%



Appendix Table 3. Number of days from emergence to last flowering

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	67	66	67	200	66.67
CGP110	67	68	67	202	67.33
CGP 18A	66	67	66	199	66.33
CGP 34	67	67	67	201	67.00
CGP 59	66	66	67	199	66.33
CLG	67	68	67	202	67.33

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.33	0.17			
Treatment	5	3.17	0.63	2.1 ^{ns}	3.33	5.64
Error	10	3	0.3			
TOTAL	17	6.5				

^{ns} - Not significant

Coefficient of variation=0.82%



Appendix Table 4. Number of days from flowering to pod setting

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	2	3	2	7	2.33
CGP110	2	2	3	7	2.33
CGP 18A	2	2	2	6	2.00
CGP 34	2	2	3	7	2.33
CGP 59	2	3	2	7	2.33
CLG	2	2	3	7	2.33

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	0.05	0.01
Replication	2	0.78	0.39				
Treatment	5	0.28	0.06	0.23 ^{ns}	3.33	5.64	
Error	10	2.55	0.26				
TOTAL	17	6.5					

^{ns}- Not significant

Coefficient of variation=22.41%



Appendix Table 5. Number of days from flowering to first harvest

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	7	6	7	20	6.67
CGP110	6	6	7	19	6.33
CGP 18A	6	6	6	18	6.00
CGP 34	7	6	7	20	6.67
CGP 59	6	7	7	20	6.67
CLG	6	6	6	18	6.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.78	0.39			
Treatment	5	1.61	0.32	1.68 ^{ns}	3.33	5.64
Error	10	1.89	0.19			
TOTAL	17	4.28				

^{ns} - Not significant

Coefficient of variation=6.82%



Appendix Table 6. Number of days from flowering to last harvest

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	38	39	37	114	38.00
CGP 110	38	39	39	116	38.67
CGP 18A	37	38	36	111	37.00
CGP 34	39	37	37	113	37.67
CGP 59	38	39	36	113	37.67
CLG	39	36	38	113	37.67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	3.4	1.7			
Treatment	5	4.4	0.88	0.66 ^{ns}	3.33	5.64
Error	10	13.31	1.33			
TOTAL	17	21.11				

^{ns} - Not significant

Coefficient of variation=3.05%



Appendix Table 7. Leaflet length (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	3.56	3.58	3.56	10.7	3.57
CGP 110	3.68	3.69	3.39	10.76	3.59
CGP 18A	3.77	3.95	4.2	11.92	3.97
CGP 34	3.46	3.51	3.49	10.46	3.49
CGP 59	3.63	3.67	3.57	19.87	3.62
CLG	3.76	3.66	3.74	11.16	3.72

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0	0			
Treatment	5	0.44	0.09	4.5*	3.33	5.64
Error	10	0.16	0.02			
TOTAL	17	0.60				

*- Significant

Coefficient of variation=3.86%



Appendix Table 8. Leaflet width (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	2.79	2.57	2.5	7.86	2.62
CGP 110	2.8	2.53	2.61	7.94	2.65
CGP 18A	2.9	2.72	2.71	8.12	2.71
CGP 34	2.59	2.4	2.59	7.58	2.53
CGP 59	2.74	2.64	2.62	8.00	2.67
CLG	2.95	2.71	2.7	8.36	2.79

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.09	0.05			
Treatment	5	0.12	0.02	2.86 ^{ns}	3.33	5.64
Error	10	0.07	0.007			
TOTAL	17	0.28				

^{ns} - Not significant

Coefficient of variation=3.15%



Appendix Table 9. Plant height at 35 DAP (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	36	34.8	47.5	118.30	39.43
CGP 110	31	43.3	31.4	105.70	35.43
CGP 18A	36.1	37.9	41.2	115.30	38.40
CGP 34	30.6	43.2	29.2	103.00	34.33
CGP 59	35.7	40.7	34	110.40	36.80
CLG	30.1	38.9	35.4	104.40	34.80

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	128.73	64.37			
Treatment	5	64.18	12.84	0.49 ^{ns}	3.33	5.64
Error	10	263.39	26.34			
TOTAL	17	0.60				

^{ns} - Not significant

Coefficient of variation=14.06%



Appendix Table 10. Plant height at last harvest (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	170.3	172.3	111.8	454.40	151.47
CGP 110	152	139	114.8	405.80	135.27
CGP 18A	172.3	170.7	116.8	459.80	153.27
CGP 34	170.2	169.9	101.5	441.60	147.20
CGP 59	152	162.2	113.1	427.30	142.43
CLG	154.5	142.5	110	389.00	129.67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	9238.03	4619.02			
Treatment	5	1297.05	259.41	1.94 ^{ns}	3.33	5.64
Error	10	1338.60	133.86			
TOTAL	17	11837.68				

^{ns} - Not significant

Coefficient of variation=8.08%



Appendix Table 11. Number of nodes per plant

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	35	33	34	102.00	34.00
CGP 110	34	35	34	103.00	34.33
CGP 18A	33	36	35	104.00	34.67
CGP 34	34	36	33	103.00	34.33
CGP 59	35	33	32	100.00	33.33
CLG	32	35	32	99.00	33.00

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	5.44	2.72			
Treatment	5	6.27	1.25	0.73 ^{ns}	3.33	5.64
Error	10	17.23	1.72			
TOTAL	17	28.94				

^{ns} - Not significant

Coefficient of variation=3.86%



Appendix Table 12. Number of nodes bearing the first flower cluster

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	13	9	13	35.00	11.67
CGP 110	12	13	13	38.00	12.67
CGP 18A	11	8	9	28.00	9.33
CGP 34	13	14	12	29.00	13.00
CGP 59	11	9	10	30.00	10.00
CLG	9	7	10	26.00	8.67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	7.45	3.73			
Treatment	5	49.11	9.82	5.71**	3.33	5.64
Error	10	17.22	1.72			
TOTAL	17	73.78				

** - Highly significant

Coefficient of variation=12.04%



Appendix Table 13. Number of nodes bearing the last pod cluster

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	31	28	30	29.00	29.67
CGP 110	29	28	28	85.00	28.33
CGP 18A	30	31	30	91.00	30.33
CGP 34	32	30	29	91.00	30.33
CGP 59	29	29	30	88.00	29.33
CLG	27	29	29	85.00	28.33

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.78	0.39			
Treatment	5	12.28	2.46	1.86 ^{ns}	3.33	5.64
Error	10	13.22	1.32			
TOTAL	17	26.28				

^{ns} - Not significant

Coefficient of variation=4.46%



Appendix Table 14. Number of flowers per cluster

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	2	2	2	6	2.00
CGP 110	1	1	2	4	1.33
CGP 18A	2	1	2	5	1.69
CGP 34	2	2	2	6	2.00
CGP 59	1	2	2	5	1.66
CLG	2	2	2	6	2.00

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.53	0.53			
Treatment	5	0.93	0.23	1.28 ^{ns}	3.48	5.99
Error	10	1.47	0.15			
TOTAL	17	2.93				

^{ns} - Not significant

Coefficient of variation=24.52%



Appendix Table 15. Pod length (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	8	8.2	8.5	24.70	8.23
CGP 110	7.2	7	7.1	21.30	7.10
CGP 18A	8.4	8.1	8.3	24.80	8.27
CGP 34	7.3	8	7.6	22.90	7.63
CGP 59	7.2	7	6.8	21.00	7.00
CLG	7.2	7.4	7.4	22.00	7.33

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.018	0.009			
Treatment	5	4.58	0.92	18.4**	3.33	5.64
Error	10	0.53	0.05			
TOTAL	17	5.13				

**- Highly significant

Coefficient of variation=2.95%



Appendix Table 16. Pod width (cm)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	1.5	1.5	1.5	4.50	1.50
CGP 110	1.4	1.3	1.3	4.00	1.33
CGP 18A	1.9	1.8	1.6	5.30	1.77
CGP 34	1.3	1.5	1.5	4.30	1.43
CGP 59	1.5	1.5	1.4	4.40	1.47
CLG	1.4	1.4	1.5	4.30	1.43

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.018	0.009			
Treatment	5	4.58	0.92	18.4**	3.33	5.64
Error	10	0.53	0.05			
TOTAL	17	5.13				

**- Highly significant

Coefficient of variation=6.00%



Appendix Table 17. Marketable yield (kg/ 1 x 5 m plot)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	7.07	5.79	5.76	18.62	6.21
CGP 110	8.5	7.68	7.15	23.33	7.78
CGP 18A	6.83	7.91	6.59	21.33	7.11
CGP 34	5.5	9	6.96	21.46	7.15
CGP 59	5.71	6.09	5.79	17.59	5.86
CLG	7.5	6.09	7.97	21.56	7.19

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.46	0.23			
Treatment	5	7.54	1.51	1.4 ^{ns}	3.33	5.64
Error	10	10.74	1.07			
TOTAL	17	18.74				

^{ns} - Not significant

Coefficient of variation=15.04%



Appendix Table 18. Non-marketable yield (kg/ 1 x 5 m plot)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	0.298	0.42	0.455	1.17	0.39
CGP 110	0.236	0.79	0.32	1.44	0.48
CGP 18A	0.479	0.268	0.78	1.53	0.51
CGP 34	0.378	0.423	0.329	1.13	0.38
CGP 59	0.38	0.244	0.51	1.13	0.38
CLG	0.428	0.378	0.443	1.25	0.42

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.03	0.02			
Treatment	5	0.04	0.008	2.67 ^{ns}	3.33	5.64
Error	10	0.3	0.003			
TOTAL	17	0.38				

^{ns} - Not significant

Coefficient of variation=12.74%



Appendix Table 20.Total yield (kg/ 1 x 5 m plot)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	7.368	6.21	6.215	19.79	6.60
CGP 110	8.826	8.17	7.47	24.47	8.16
CGP 18A	7.309	8.178	7.37	22.86	7.62
CGP 34	5.878	9.423	6.919	22.22	7.41
CGP 59	5.88	6.034	6.3	18.48	6.16
CLG	7.298	6.458	8.413	22.80	7.60

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.38	0.19			
Treatment	5	8.16	1.63	1.54 ^{ns}	3.33	5.64
Error	10	10.63	1.06			
TOTAL	17	19.17				

^{ns} - Not significant

Coefficient of variation=14.18 %



Appendix Table 19. Number of pod pickings

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	7	7	7	21.00	7.00
CGP 110	7	7	7	21.00	7.00
CGP 18A	6	6	6	18.00	6.00
CGP 34	6	6	6	18.00	6.00
CGP 59	7	6	7	20.00	6.67
CLG	7	7	7	21.00	7.00

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.11	0.06			
Treatment	5	3.61	0.72	12**	3.33	5.64
Error	10	0.56	0.06			
TOTAL	17	4.28				

**- Highly significant

Coefficient of variation=3.77%



Appendix Table 21. Computed yield per hectare (kg)

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	14736	12420	12430	39586.00	13195.33
CGP 110	17652	16340	14940	48932.00	16310.67
CGP 18A	14618	16356	14740	45714.00	15238.00
CGP 34	11756	18846	13838	44440.00	14813.33
CGP 59	11760	12608	12600	36968.00	12322.67
CLG	15856	12916	16826	45598.00	15199.33

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	1532012.33	766006.17			
Treatment	5	32556867.67	6511373.53	1.54 ^{ns}	3.33	5.64
Error	10	42196361	4291636.1			
TOTAL	17	77005241				

^{ns} - Not significant

Coefficient of variation=14.27 %



Appendix Table 22. Rating on insect pest (leaf miner) incidence

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	3	4	3	10.00	3.33
CGP 110	3	3	3	9.00	3.00
CGP 18A	3	3	4	10.00	3.33
CGP 34	4	3	3	10.00	3.33
CGP 59	4	4	4	12.00	4.00
CLG	4	3	4	11.00	3.67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.11	0.06			
Treatment	5	1.77	0.35	1.35 ^{ns}	3.33	5.64
Error	10	2.56	0.26			
TOTAL	17	4.44				

^{ns} - Not significant

Coefficient of variation=15.27 %



Appendix Table 23. Rating on disease (powdery mildew) incidence

LINES	REPLICATIONS			TOTAL	MEAN
	I	II	III		
CGP 13	3	4	3	10.00	3.33
CGP 110	3	3	3	9.00	3.00
CGP 18A	3	3	4	10.00	3.33
CGP 34	4	3	3	10.00	3.33
CGP 59	4	4	4	12.00	4.00
CLG	4	3	4	11.00	3.67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.11	0.06			
Treatment	5	1.77	0.35	1.35 ^{ns}	3.33	5.64
Error	10	2.56	0.26			
TOTAL	17	4.44				

^{ns} - Not significant

Coefficient of variation=15.27 %



Benguet State University
COLLEGE OF AGRICULTURE
La Trinidad, Benguet

April 5, 2010

Date

APPLICATION FOR MANUSCRIPT ORAL DEFENCE

Name: EFREN T. BENIASAN

Degree(Major Field): BS in AGRICULTURE (HORTICULTURE)

Title of Research: PILOT TESTING OF GARDEN PEA (*Pisum sativum L.*) LINES
UNDER TOPDAC, ATOK, BENGUET CONDITION

Endorsed: Percival B. Alipit

Adviser and Chairperson, Advisory Committee

Date and Time of Defense: April 5, 2010 - 8 to 10AM

Place of Defense: AC 201

Approved:

Percival B. Alipit

Araceli G. Ladilad

Member, Advisory Committee

Member, Advisory Committee
and Department Chairperson

RESULT OF ORAL DEFENCE

Name and Signature	Remarks (Passed/Failed)
<u>Percival B. Alipit</u> Adviser and Chairperson, Advisory Committee	_____
<u>Fernando R. Gonzales</u> Member Advisory Committee	_____
<u>Araceli G. Ladilad</u> Member, Advisory Committee and Department Chairperson	_____

