BIBLIOGRAPHY

DONGLAL, GLENDA P. APRIL 2011. Growth, Fresh Pod Yield, Acceptability and Post-Harvest Quality of Selected Advanced Lines of Garden Pea. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The seven selected advanced lines of garden pea were characterized and evaluated based on their agromorphological characteristics, growth and fresh pod yield. All lines differed significantly in majority of the parameters observed in this study. All the selected advanced lines emerged in seven DAS, flowered within 30 to 46 DAE, set pod from 40 to 51 DAE and matured five to seven days from pod setting.

Based on the cost and return analysis from growing the selected advanced lines evaluated, line 153-1 gave highest profit followed by lines 153-2 and 109-2.

Line 109-1 and CLG were most accepted and very much liked by the farmers due to their pod characteristics and low weight loss during storage.

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INTRODUCTION

Garden Pea (*Pisum sativum*) known as sweet pea is one of the common crops grown by Benguet farmers. The crop originated in Europe and from there takes throughout the world. Peas are annual, leguminous plant with long, weak, herbaceous stems. The stems are about to 24 inches to 28 inches long. The pale green leaves consists of one to three leaflet with a terminal tendril the blossom are reddish purple or white, the pods usually contain four to nine seeds (Dolorit, 1974). This legume is an important garden and field crop throughout the temperate regions, where it is grown for fresh peas. In the tropics, a garden pea is grown only at high altitude or during the cool season. Like most legumes, garden pea is a good source of protein and vitamins. The fresh green pod of garden pea contains 6.7% protein, 6.4% fat, 15.5% carbohydrates and 2.2% fiber (Purseglove, 1972). In addition, garden pea is able to fix nitrogen but it still needs supplemental application of fertilizer to supply the major elements required in order for the plant to attain maximum yield.

Since garden pea is one of the most important food legumes in term of world production, there is a need to introduce and evaluate new breeding line in order to know the best varieties that are best suited in an area. Most of the accepted variety of garden pea is high yielding and resistant to pest and disease. Consumer's preference must also be considered because even if a variety is high yielding if the consumers or the farmer growers do not like its pod and other traits, it would affect its demand or marketability.

Highland farmers like in Benguet cannot identify the exact variety of garden pea which gives higher yield with good quality pods. Therefore it is important for them to note some of the new breeding lines of garden pea. This study will help Benguet farmers

to choose and determine which line is suitable in local condition of La Trinidad during regular cropping season when the demand for the crop is great.

This study was undertaken with the following objectives:

1. to characterize and evaluate the selected advanced lines of garden pea in La Trinidad, Benguet;
2. to determine the acceptability and post harvest quality of selected advanced lines of garden pea in La Trinidad, Benguet; and
3. to determine the profitability on producing selected advanced lines of garden pea in La Trinidad, Benguet.

The study was conducted at Benguet State University – Institute of Plant Breeding Highland Crop Research Station (BSU-IPB HCRS) experimental field from November, 2010 to February, 2011.

REVIEW OF LITERATURE

Varietal Evaluation and Selection

The variety to be selected should be high yielding, resistant to pest and diseases, and early maturing. These traits would make possible the growing of a crop less expensive and more productive. Moreover choosing the right variety will minimize problems associated with water and fertilizer management so that high yield will be obtained. Yield performance of any variety is affected by environmental factors like soil condition, climate and incidence of pest and diseases (PCARRD, 1989).

Bay-an (2000) reported that many of the agricultural experimental stations conducting varietal screening of economical crops recommended varieties to determine if it is adapted to a particular area or condition where the crop is to be planted.

To know the best variety to plant must be the first consideration in planting garden pea. The best variety that is adapted to the locality should be selected. Using the right variety ensures high yield and better quality of the produce. However, before a variety is recommended it has to undergo a series of varietal evaluation.

Trial planting will be done to test new varieties suitable to a certain locality before planting in a wide scale. Varietal evaluation is important in order to observe performance character such as high yielding, vigor and maturity. These qualities are seldom found in one variety. A farmer has to select for the right variety that suit his own condition and consumer needs as well (HARRDEC, 1996).

Annogue (1997) evaluated eleven promising lines of garden pea under La Trinidad Benguet condition. He reported that CGP 158 produced the highest yield per plot and per hectare. It was the earliest to mature and it produced the most number of

pods per hectare. CGP 158 was also resistant to leaf miner and produced good quality pods and seeds.

Bay-an (2000) evaluated the performance and acceptability of six promising garden pea variety produced by BSU-IPB HRCS in Atok, Benguet. Results showed that all the six varieties were suitable to the locality because if their good yield which ranged from 2.82-4.61 tons per hectare. They were also vigorous and mildly resistant to leaf miner. Trinidad was highest yielder but it was moderately liked because of its bigger pods. Taichung 89-001 and the Chinese garden pea were preferred due to their small pods.

In 2006, Gawidan evaluated ten garden pea entries for both fresh pod and seed yield under La Trinidad condition. Significant differences were observed among the ten entries of garden pea evaluated in terms of number of days to first and last flowering, number of nodes to first flower, number of pods per plant, pod width and fresh pod yield per plot. N2634, 89-001 and CLG produced the highest fresh pod yield per plot per hectare. CGP 59 was observed to have moderate resistance to leaf miner and Ascochyta leaf spot.

Recently, Del-amen (2009) evaluated the performance and farmers acceptability of six promising lines of garden pea. Result showed that the six promising lines were suitable in Madaymen because of their good growth and fresh pod yield that ranged from 8.65-11.43 kg/10m^2. They were all vigorous and highly resistant to leaf miner and powdery mildew. CGP 34 and CGP 110 were the tallest while Kalantao was the shortest at 35 DAP. All the six lines showed high resistance to leaf miner and powdery mildew except for the CGP 18A which had mild resistance to powdery mildew. CGP 110 and

Kalantao produced the highest marketable and total fresh pod yield per plot but Kalantao was disliked by the farmers because of its big sized and curve pods, despite of its sweetness and crunchiness.

Storage Conditions for Fresh Vegetables

Harvested perishable products are living tissues with continuing metabolism, and are thus subject to respiration, water loss and cell softening throughout the post harvest system. The storage life of a product varies with species, variety and pre-harvest conditions particularly quality and maturity. That given much scope for control lies in post harvest management of the two most important determinants of storage life and quality, which are respiration and transpiration. Both needs to be limited but not stopped and proper control of temperature and relative humidity is the key to maximizing storage life and marketable quality (Beattie, 1992).

Ware (1975) stated that vegetables vary widely in perishability some can be stored for several months, while others retain quality for only three or four days in storage. For those that stored well, storage is essential to prolong the season and facilitates orderly marketing. Many of the very perishable crops are often grown some distance from market. They have to be handled promptly and stored under proper conditions until they reach the consumer.

Fresh vegetables intended for storage should be as free as possible from skin breaks, bruises, decay and other deterioration. Bruises and other mechanical damage not only destruct the appearance of the product but are the principal avenues for entrance of decay organisms. Mechanical damage also increases moisture loss.

Maximum storage life of vegetables can be obtained by storing a high quality product harvested at the right maturity, free from injuries and diseases, and stored promptly. Keeping quality may be influenced by cultivar, climate, soil, cultural conditions, maturity and handling practices before storage.

MATERIALS AND METHODS

An area of 135 m^2 was thoroughly cleaned and prepared. The area was divided into three blocks, consisting of nine plots each with a dimension of 1m x $5m^2$ including border plots. The treatments were laid out using Randomized Complete Block Design (RCBD) with three replications.

Two seeds per hill were sown at a depth of 2-3 cm with a distance of 20cm between hills and between rows. There were two rows per plot. All the necessary cultural and management practices of farmers growing garden pea were employed uniformly such as weeding, irrigation, and others. Trellis was provided at 35 day after planting; Vines were bound with plastic twine allowing the plants to cling to the trellis.

The following selected advanced lines together with the commercial variety and newly NSIC Approved Variety were obtained from Benguet State University- Institute of Plant Breeding (BSU-IPB) Highland Crop Research Station (HCRS) served as treatments:

Treatment	Advanced line
T_1	148-2
T_2	109-1
T_3	109-2
T_4	153-1
T_5	153-2
T_6	Betag
$T_{7\ (ck)}$	Chinese light green

Data Gathered

A. Quantitative Characters

1. Maturity

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

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 plant per plot had at least two fully opened flowers.

c. Number of days from flowering to pod setting. This was obtained by counting the numbers of days from flowering until the pods begin to develop.

d. Number of days from pod setting to pod maturity. This was recorded by counting the number of days from pod setting to pod maturity.

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

2. Leaf Characteristics

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

b. Leaflet width (cm). Leaf width of ten samples used in gathering leaf length was gathered by measuring the broadest part of the leaf using a foot rule at 35 days after planting.

c. Number of leaves per plant. This was recorded by counting the number of leaves of ten sample plants per replication during harvesting.

d. Tendril length (cm). This was measured from the base to the tip of the ten random sample tendril per treatment using a ruler when pod were fully mature.

3. Stem Characteristics

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

b. Node number bearing first flower cluster. This was recorded by counting the node from the base of the plant to the node bearing the first flower cluster in five sample plants per treatment.

c. Node number bearing first pod. This was recorded by counting the node bearing first pod cluster in five sample plants per treatment.

d. Node number bearing last pod. This was recorded by counting the node bearing last pod cluster in five sample plants per treatment.

e. Internodes length (cm). This was measured by getting the mean length of three internodes at the midpoint of the plant.

f. Number of branches. This was obtained by counting the number of branches of the plants one week before harvesting.

g. Plant height at maturity (cm). This was measured from the base of the plant to the tip in ten sample plant using a meter stick at maturity.

4. Flower Characteristics

a. Number of flowers per plant. This was recorded by counting the flowers per plant in ten sample plants per treatment per replication at the peak of flowering.

b. Number of flowers per cluster. This was recorded by counting the flowers per cluster in ten sample plants per treatment per replication at the peak of flowering.

c. Number of flower clusters per plant. This was recorded by counting the flower cluster per plant in ten sample plants per treatment per replication around 50 days after planting.

d. Plant height at flowering (cm). This was recorded by measuring the height of the plant from the base of the plant to the first flower.

5. Pod Characteristics

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

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

c. Number of pods per cluster. This was obtained by getting the number of pods per cluster from ten random sample plants per plot.

d. Number of pod per plant. This was obtained by counting the number of pods per plant from ten sample plants per plot.

e. Percent pod set per plant. This was computed using the formula:

$$\text{Percent pod set (\%)} = \frac{\text{total number of pods per plant}}{\text{total number of flowers per plant}} \times 100$$

f. Pod straightness. This was recorded as irregular, curve or straight.

6. Yield Characteristics

a. Weight of marketable fresh pods per plot (kg/5m^2). This was recorded by weighing the marketable pods per plot from first to last harvest. Marketable pods are straight pods, smooth, and free from damages.

b. Weight of non-marketable pods per plot (kg/5m^2). This was recorded by weighing the non- marketable pods per plot per treatment. These are the pods that are over-matured, malformed and damaged by insects pest and diseases.

c. Total yield per plot (kg/5m^2). This was recorded by getting the total weight of marketable and non-marketable pods per plot per treatment throughout the harvest period.

d. Computed pod yield (tons/ha). This was recorded by multiplying the total yield per plot in kg/5m^2 x 2.0, Where 2.0 is the factor used to convert yield per plot (kg/5m$^{2)}$ in ton/ha assuming one hectare effective area.

B. Qualitative Characters

1. Leaf color. This was recorded as green, light green, yellow, dark green.

2. Flower color. This was recorded when 50% of the plant per plot have fully opened flowers.

3. Pod color. This was recorded as green, light green, yellow, dark green.

4. Pod shape. This was recorded as flat, round, curve or straight.

5. Stringiness. This was recorded during the harvest and recorded whether green pod is stingy or string less, stringy if there is pod suture string when snapped and string less when there is no pod suture.

6. Waxiness of pod. This was recorded by observing the presence or absence of wax in the pods.

7. Shininess of pod. This was recorded as shiny, dull or glossy.

8. Reaction to leaf miner infestation. This was gathered using the following scale used by Tandang *et al.* (2008):

Scale	Description	Remarks
1	No damage/infestation	Highly resistant
2	1-25% infestations	Moderately resistant
3	26-50% infestations	Resistant
4	51-75% infestations	Moderately susceptible
5	76-100% infestations	Very susceptible

9. Reaction to powdery mildew. This was gathered using the following scale used by Tandang *et al.* (2008):

Scale	Description	Remarks
1	No damage/infestation	Highly resistant
2	1-25% of the total leaves per plants per plot are infected	Moderately resistant
3	26-50% of the total leaves per plants per plot are infected	Resistant
4	51-75% of the total leaves per plants per plot are infected	Moderately susceptible
5	76-100% of the total leaves per plants per plot are infected	Very susceptible

10. Farmer's preferences. Ten farmers were invited to make their own selection and express their reasons for accepting and not accepting the selected advanced lines of

garden pea. Selection was based on pod yield and quality after harvest. Other reasons for selecting were noted.

Sensory evaluation of selected advanced lines was done by the farmers according to growth, pod appearance, pod color, crunchiness, and their general acceptability.

11. Return on Cash Expense (ROCE). This was determined using the following formula:

$$\text{ROCE (\%)} = \frac{\text{Gross Sales- Total Expenses}}{\text{Total expenses}} \times 100$$

12. Post harvest characteristics. This includes the loss in weight, the change in color, appearance, and crunchiness of pods per treatment.

a. Loss in weight. This was computed by subtracting from initial weight (the weight just harvest), the final weight (the weight of pods after one week storage under ordinary room condition)

b. Pod color. Pods per treatment were observed for their predominant color in seven days after storage.

c. Pod appearance. Pods per treatment were observed for their appearance in seven days after storage.

d. Crunchiness. Pods were evaluated whether they are crunchy, slightly crunchy and not crunchy.

Analysis of Data

All quantitative data were analyzed using the Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) with three replications. The significance of differences among treatment means were tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Number of Days from Emergence
to Flowering and Pod Setting

The seven advanced lines of garden pea studied emerged within seven days after sowing. Betag was the earliest to produce flower within 30 days after emergence (DAE) and 109-1 was the latest to flower at 46 days after emergence (Table 1).

Lines 148-2, 153-2 and Betag produced pod two days earlier than the lines 153-1 and CLG with in 40 DAE. Lines 109-1 and 109-2 were the latest period to produce pods at 51 DAE.

Table 1. Number of days from emergence to flowering and pod setting of the seven selected advanced lines of garden pea

LINES	NUMBER OF DAYS FROM EMERGENCE TO	
	FLOWERING	POD SETTING
148-2	30[e]	40[c]
153-1	37[c]	42[b]
153-2	35[d]	40[c]
109-1	46[a]	51[a]
109-2	44[b]	51[a]
Betag	30[e]	40[c]
CLG (ck)	35[d]	42[b]
CV (%)	00	00

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Number of days from Pod setting to Pod Maturity from Emergence to First and Last Harvesting

Table 2 shows that lines 153-1, 153-2 and 109-1 the earliest to set pod five days after flowering. Other advanced lines set pod two to five days later. Table 2 also shows the number of days from pod setting to maturity. The lines first harvested are 148-2,153-1,153-2 and Betag with in 47 DAE. Lines 109-1, 109-2 and CLG were harvested nine days later. The seven selected advanced lines of garden pea differed significantly in the number of days from emergence to last harvesting (Table 2). Lines 148-2, 153-1, 153-2 and Betag reached last pod harvesting within 65 DAE while 109-1, 109-2 and CLG had last harvesting four days later.

Table 2. Number of days from flowering to pod setting, from pod setting to pod maturity, from emergence to last harvesting of advanced lines of garden pea

LINES	NUMBER OF DAYS FROM		
	POD SETTING TO POD MATURITY	EMERGENCE TO HARVESTING	
		FIRST	LAST
148-2	7[a]	47[b]	65[b]
153-4	5[c]	47[b]	65[b]
153-2	7[b]	47[b]	65[b]
109-1	5[c]	56[a]	69[a]
109-2	5[c]	56[a]	69[a]
Betag	7[b]	47[b]	65[b]
CLG	5[c]	56a	69[a]
CV (%)	00	00	00

Node Number Bearing First Flower,
First and Last Pod

Table 3 shows the node number bearing first flower cluster, first pod and last pod. Results showed that the seven selected advanced lines of garden pea produced their first flower cluster and first pod on their 7^{th} to 15^{th} node. The last pod developed on the 10^{th} to 19^{th} node. Lines 148-2 produced first flower cluster within the seventh node and first pod developed at 10^{th} node. Line 109-2 had the highest node number bearing first flower cluster in the 15^{th} node where first pod also developed while its last pod developed at 19^{th} node. Other lines developed their first pod at the 11^{th} to 12^{th} node and last pod at 14^{th} node. The differences observed in this study could be attributed to their genetic differences.

Table 3. Node number bearing first flower cluster, first and last pod of the seven advanced lines of garden pea

LINES	NODE NUMBER BEARING		
	FIRST FLOWER CLUSTER	FIRST POD	LAST POD
148-2	7^{e}	7^{e}	10^{d}
153-1	11^{c}	11^{c}	14^{c}
153-2	11^{c}	11^{c}	14^{c}
109-1	12^{b}	12^{b}	18^{b}
109-2	15^{a}	15^{a}	19^{a}
Betag	11^{c}	11^{c}	14^{c}
CLG	10^{d}	10^{d}	14^{c}
CV (%)	2.88	2.88	2.19

Number of Flower Cluster per Plant
Flower per Cluster, Flower per Plant

Highly significant differences among the seven selected advanced lines of garden pea were noted on the number of flowers cluster per plant (Table 4). Line 153-1 and 153-2 had the least flower cluster per plant (3). Line 109-1 had the highest number of flower cluster per plant followed by Betag. Other line had four to five flower clusters per plant.

The six advanced lines were observed to have two flowers per cluster except for Betag which had only one flower per cluster (Table 4). Line 109-1 had 12 flowers per plant while the other lines had five to nine flowers per plant. The six lines produced purple flower except CLG that produced white flowers.

Table 4. Number of flower cluster per plant, flower per cluster and flower per plant of seven advanced lines of garden pea

LINES	NUMBER OF FLOWER		
	CLUSTER PER PLANT	PER CLUSTER	PER PLANT
148-2	4[c]	2[a]	8[c]
153-1	3[d]	2[a]	6[d]
153-2	3[d]	2[a]	6[d]
109-1	6[a]	2[a]	12[a]
109-2	4[c]	2[a]	9[b]
Betag	5[b]	1[b]	5[e]
CLG	4[c]	2[a]	8[c]
CV (%)	7.39	00	6.09

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Number of Branches, Nodes and Leaves per Plant

There were highly significant differences among the treatment means of seven selected advanced lines of garden pea based in the number of branches per plant, number of node plant and number of leaves per plant (Table 5). All the lines had one branch except for CLG which had two branches per plant. The number of branches differed significantly among the selected advanced lines evaluated which could be due to their genetic differences. Line 109-1 had the highest number of nodes per plant while line 148-2 had the least number of nodes. Line 109-2 had 409 leaves per plant. Other lines had 289 to 391 leaves.

Table 5. Number of branches, nodes and leaves per plant of the seven advanced lines of garden pea

LINES	NUMBER OF		
	BRANCHES PER PLANT	NODE PER PLANT	LEAVES PER PLANT
148-2	1[b]	11[d]	289[c]
153-1	1[b]	15[c]	391[a]
153-2	1[b]	15[c]	368[ab]
109-1	1[b]	19[a]	372[ab]
109-2	1[b]	16[b]	409[a]
Betag	1[b]	16[b]	380[ab]
CLG	2[a]	15[c]	330[cb]
CV (%)	18.33	1.47	7.82

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Number of Pods per Cluster and per Plant

There were highly significant differences were noted on the number of pods per cluster among the selected advanced lines studied. The selected advanced lines were double-podded except Betag which had only one pod per cluster (Table 6).

The seven selected advanced lines evaluated also differed significantly in terms of number of pods per plant. Lines 109-1 produced the highest number of pods per plant followed by 109-2 while 153-2 and Betag produced the fewest pods per plant. Other line had six to eight pods per plant (Table 6).

Table 6. Number of pods per cluster and pods per plant of the seven advanced lines of garden pea

LINES	NUMBER OF PODS	
	PER CLUSTER	PER PLANT
148-2	2 [a]	7 [c]
153-1	2 [a]	6 [d]
153-2	2 [a]	5 [e]
109-1	2 [a]	12 [a]
109-2	2 [a]	8 [b]
Betag	1 [b]	5 [e]
CLG	2 [a]	7 [c]
CV (%)	00	19.43

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Internodes and Tendril Length

There were highly significant differences in the internodes and tendril length among the seven advanced lines of garden pea (Table 7).

The selected advanced lines of garden pea 109-1 had the longest internode while CLG had the shortest internode. Lines 148-2 had the longest tendril followed by 109-1 and CLG. The shortest tendril was measured in line 153-2.

Plant Height at Flowering and Maturity

There were highly significant differences observed on plant height at period of flowering and maturity. The seven selected advanced lines of garden pea line 109-1 had the tallest plant at flowering and maturity stage.

Table 7. Internodes and tendril length of seven advanced lines of garden pea

LINE	INTERNODE LENGTH (cm)	TENDRIL LENGTH (cm)
148-2	8.03 [e]	10.33 [a]
153-1	8.15 [d]	7.76 [d]
153-2	7.85 [f]	6.20 [f]
109-1	8.76 [a]	9.66 [b]
109-2	8.47 [b]	6.86 [e]
Betag	8.22 [c]	8.20 [cd]
CLG	6.92 [g]	8.50 [c]
CV (%)	0.23	4.36

Means with the same letter are not significantly different at 5% level of significant using DMRT.

It was followed by 109-2. The shortest plants were recorded, in CLG at flowering and in line 148-2 at maturity stage together with CLG. There was an increasing height measurement from flowering to maturity as showed on Table 8.

Pod Width and Length

Highly significant differences were noted on the length and width of pods among the treatment means of garden pea lines evaluated. Betag had the longest pod and lines 153-1 had the shortest pod together with 109-1, 153-2 and CLG. The widest pods measured were lines 148-2 and CLG had narrowest pods.

Table 8. Plant height at flowering and maturity of seven advanced lines of garden pea

LINES	PLANT HEIGHT AT	
	FLOWERING (cm)	MATURITY (cm)
148-2	75[f]	89[e]
153-1	91[d]	108[d]
153-2	95[c]	106[d]
109-1	112[a]	147[a]
109-2	107[b]	138[b]
Betag	86[e]	128[c]
CLG	74[g]	93[e]
CV (%)	0.24	1.25

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Table 9. Pod length and width of seven advanced lines of garden pea

LINES	POD LENGTH (cm)	POD WIDTH (cm)
148-2	7.95[b]	1.50[a]
153-1	6.81[g]	1.33[f]
153-2	6.84[f]	1.49[b]
109-1	6.91[e]	1.41[d]
109-2	7.26[c]	1.37[e]
Betag	8.12[a]	1.43[c]
CLG	6.93[d]	1.27[g]
CV (%)	0.18	0.42

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Terminal Leaflet Length and Width

Highly significant differences were noted on the terminal leaflet length and width among the advanced lines of garden pea evaluated. Betag had the longest and widest terminal leaflet while CLG had the shortest and narrowest terminal leaflet length (table 10).

Reaction to Leaf Miner and Powdery Mildew

All the seven selected advanced lines of garden pea evaluated exhibited moderate resistance to leaf miner infestation and moderate susceptibility to powdery mildew at 65 days after emergence.

Table 10. Leaflet length and width of seven advanced lines of garden pea

LINES	LEAFLET	
	LENGTH(cm)	WIDTH(cm)
148-2	5.11[c]	4.16[c]
153-1	4.85[d]	3.36[f]
153-2	5.30[b]	4.34[b]
109-1	5.07[c]	3.73[d]
109-2	4.94[d]	3.48[e]
Betag	5.43[a]	4.47[a]
CLG	4.07[b]	3.13[g]
CV (%)	1.04	1.69

Means with the same letter are not significantly different at 5% level of significant using DMRT.

Weight of fresh pod yield per plot (kg/5m^2)

Table 11 shows that there were significant differences among the seven selected advanced lines of garden pea in term of fresh pod yield per plot. Betag had the highest weight of marketable fresh pod yield per plot (2.02kg/5m^2). Other lines had 1.54 to 1.82kg/5m^2. CLG had the lowest weight of marketable and non-marketable fresh pod yield per plot (1.46kg/5m^2 and 0.46kg/5m^2. Line 153-2 had the highest weight of non-marketable fresh pod yield.

The pods harvested per plot throughout the harvesting period were not all marketable pods due to late harvesting, leaf miner infestation and powdery mildew infection. Betag produced significantly highest total fresh pod yield about 2.54kg/5m^2

while CLG produced lowest total yield (1.90kg). other lines produced 2.32kg to 2.45kg/5m^2. It was significantly different from the total yield of other treatment means (Table 11).

There were also significant differences on the computed yield per hectare. Amng the selected advanced lines of garden pea studied Betag produced the highest fresh pod yield per hectare (5.08T/ha) and CLG produced the lowest yield of 3.80T/ha. Other lines produced 4.64 to 4.90 T/ha of fresh pod yield.

Leaf, Flower and Pod Characteristics

CLG had light green leaf while the six lines had medium green leaves. All lines were observed to have purple flower except for CLG which had white flowers. Line 109-1 and CLG had light green pod color. All the six lines had straight, flat pod shape except

Table 11. Weight of fresh pod yield per plot of seven advanced lines of garden pea

	FRESH POD YIELD (kg/5m^2)			
LINES	MARKETABLE	NON-MARKETABLE	TOTAL YIELD	COMPUTED YIELD (T/ha)
148-2	1.76^{c}	0.560^{bc}	2.32^{d}	4.64^{e}
153-1	1.82^{b}	0.590^{b}	2.41^{bc}	4.82^{c}
153-2	1.81^{bc}	0.640^{a}	2.45^{b}	4.90^{b}
109-1	1.54^{d}	0.520^{c}	2.06^{e}	4.12^{f}
109-2	1.81^{bc}	0.570^{bc}	2.39c	4.78^{d}
Betag	2.02^{a}	0.520^{c}	2.54^{a}	5.08^{a}
CLG	1.46^{e}	0.430^{d}	1.90^{f}	3.80^{g}
CV (%)	5.11	28.68	1.37	1.91

for Betag which had slightly curve pod. The seven lines of garden pea had stringy pods. CLG and 109-1 had waxy and shiny pods and all the other five lines had non-waxy, dull pods.

Farmers Preferences

Ten farmers were invited to make their own selection among the advanced lines. Selections were based on pod yield, pod appearance, color, crunchiness and acceptability. Lines 148-2 and Betag were disliked by farmers in term of pod appearance and pod acceptability due to its broadest pods but liked in pod color and crunchiness while other lines were generally liked by the farmers. Lines 109-1 together with CLG were very much liked by the farmers in general acceptability due to its shiny pods (Table 12).

In addition, farmers considered the price of quality pods in the market as their preference. 148-2 and Betag were least preferred because of its bigger pod size that commanded lower price in the market.

Return Cash Expenses (ROCE)

Table 13 shows the different ROCE computed from growing the seven selected advanced lines evaluated. Lines 153-1 had the highest ROCE with 1.92% followed by 153-1 and 109-2. CLG and 109-1 produced negative ROCE due to lower weight of marketable pods while 148-2 (-15.11) had also negative result of ROCE because of its poor pods quality.

Table 12. Farmer's preferences of seven advanced lines of garden pea based on pod characteristics

LINES	APPEARANCE	COLOR	CRUNCHINESS	ACCEPTABILITY	REMARK
148-2	disliked	liked	liked	disliked	broad pod
153-1	liked	liked	liked	liked	Small pod
153-2	liked	liked	liked	liked	Good for storage
109-1	liked	liked	liked	very much liked	Shiny pod
109-2	liked	liked	liked	liked	Good for storage
Betag	disliked	liked	liked	disliked	Broad pod
CLG	liked	liked	liked	very much like	Shiny pod

Postharvest characteristics

One hundred grams of fresh pods per lines were weighed and observed for its pods characteristics within one week (7 days) of storage under ordinary room condition.

In this study, it was observed that 148-2,153-1 and Betag Lost 25 percent in weight after seven days of storage. 109-2, 153-2 and CLG lost 13 percent while 109-1 lost 10 percent. As to the color, appearance and crunchiness, all the garden pea selected advanced lines did not change after one week of storage but it was observed that the pod lost its freshness or pods become shriveled (Table 14).

Table 13. Cost and return analysis of seven advanced lines of garden pea

LINES	FRESH POD YIELD ($kg/5m^2$)	COST OF PRODUCTION (PhP)	GROSS INCOME (PhP)	NET INCOME (PhP)	ROCE (%)
148-2	1.76^{c}	178.57	140	-37.77	-21.15
153-1	1.82^{b}	178.57	182	3.43	1.92
153-2	1.81^{bc}	178.57	181	1.01	0.56
109-1	1.54^{d}	178.57	154	-24.57	-36.76
109-2	1.81^{bc}	178.57	181	1.01	0.56
Betag	2.02^{a}	178.57	160	-18.57	-10.39
CLG	1.46^{e}	178.57	146	-32.57	-18.24

-Total expenses include land preparation, irrigation, fertilizer, seeds and maintenance
-Selling price: 153-1,153-2,109-1,109-2, and CLG = P 100/Kg 148-2
and Betag= P80.00/ Kg.

Table 14. Loss in weight of seven selected advanced lines of garden pea after seven days storage

LINES	WEIGHT LOSS (%)	CHANGE IN COLOR
148-2	25	No change in color
153-1	25	No change in color
153-2	13	No change in color
109-1	10	No change in color
109-2	13	No change in color
Betag	25	No change in color
CLG	13	No change in color

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted to characterize and evaluate the growth and pod yield of seven advanced lines of garden pea; determine the acceptability and post-harvest quality, and also determine the ROCE of selected advanced lines of garden pea.

All the selected advanced lines emerged in seven DAS, flowered within 30 to 46 DAE, set pod from 40 to 51 DAE and matured five to seven days from pod setting.

The earliest to produce flower was Betag and line 148-2 in 30 DAE while the other lines flowered in 35 to 46 DAE. Betag had only one flower per cluster while the six lines had two flowers per cluster. They produced one to two branches, 11 to 19 nodes per plant and 289 to 409 leaves per plant. Line 109-1 had the longest internode while line 148-2 had longest tendril. Plant height did not differ significantly among the lines measured although there was increasing measurement from flowering to fresh pod maturity.

There were significant differences among the seven selected advanced lines of garden pea in term of fresh pod yield per plot. Betag had the highest weight of marketable fresh pod yield per plot (2.02kg/5m^2). Other lines had 1.54 to 1.82kg/5m^2. CLG had the lowest weight of marketable and non-marketable fresh pod yield per plot (1.46kg/5m^2 and 0.46kg/5m^2). Line 153-2 had the highest weight of non-marketable fresh pod yield. Betag produced significantly highest total fresh pod yield about 2.54kg/5m^2 while CLG produced lowest total yield (1.90kg). Other lines produced 2.32kg to 2.45kg/5m^2. It was significantly different from the total yield of other treatment means.

There were also significant differences on the computed yield per hectare. Among the selected advanced lines of garden pea studied Betag produced the highest fresh pod yield per hectare (5.08 t/ha) and CLG produced the lowest yield of 3.80 T/ha. Other lines produced 4.64 to 4.90 T/ha of fresh pod yield.

Based on the post-harvest characteristics of the selected advanced lines after one week of storage in ordinary room condition line 148-2, line153-1 and Betag had the highest weight lost 25 percent while CLG had the lowest weight lost of 10 percent.

Line 153-1 had the highest ROCE with 1.92% followed by line 153-2 and line 109-2. Other lines registered negative ROCE.

Conclusion

Highly significant differences among the seven advanced lines of garden pea were observed in majority of the parameters measured in this study. There were significant differences observed in number of flower per plant, weight of marketable fresh pod yield and total fresh yield per plot among the selected advanced lines of garden pea studied. The seven selected advanced lines of garden pea characterized were not significantly different in the number of flower per plant and weight of non-marketable fresh pod yield.

Line 109-1 had the best characteristics in term on number of flower per cluster, number of node per plant, number of pods per plant, number of pods per cluster and plant height. It is also very much liked by the farmers for its pods quality together with CLG. Betag produced the highest total fresh pod yield due to pod characteristics.

Selected advanced lines 153-1, 153-2 and 109-2 were noted to have positive ROCE due to high yield, pod quality and resistance to leaf miner. Line 109-1 had better

potential for storage under ordinary room condition within seven days after harvesting due to lesser weight loss.

Recommendation

The significant differences in the characteristics of the seven selected advanced lines of garden pea studied could be used for further evaluation. Lines 109-1, 109-2, 153-1 and 153-2 had best characters observed and measured in this study. Lines 153-1, 153-2 and 109-2 had highest ROCE. Line 109-1 had better potential for storage.

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APPENDICES

Appendix Table 1. Number of days from sowing to emergence

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	7	7	7	21	7
153 – 1	7	7	7	21	7
153 – 2	7	7	7	21	7
109 – 1	7	7	7	21	7
109 – 2	7	7	7	21	7
Betag	7	7	7	21	7
CLG	7	7	7	21	7
TOTAL	49	49	49		
MEAN	7	7	7		

Appendix Table 2. Number of days from emergence to flowering

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	30	30	30	90	30[a]
153 – 1	37	37	37	111	37[c]
153 – 2	35	35	35	105	35[b]
109 – 1	46	46	46	138	46[d]
109 – 2	44	44	44	132	44[c]
Betag	30	30	30	90	30[a]
CLG	35	35	35	105	35[b]
TOTAL	257	257	257		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	Infty	3.89	6.96
Treatment	6	706.28	117.71	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	706.28				

**= Highly significant CV (%) = 0.0%

Appendix Table 3. Number of days from flowering to pod setting

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	10	10	10	30	10
153 – 1	5	5	5	15	5
153 – 2	5	5	5	15	5
109 – 1	5	5	5	15	5
109 – 2	7	7	7	21	7
Betag	10	10	10	30	10
CLG	7	7	7	21	7
TOTAL	49	49	49		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	Infty	3.89	6.96
Treatment	6	90.00	15.00	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	90.00				

**= Highly significant CV (%) = 0.0%

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

TREATMENT	BLOCK I	II	III	TOTAL	MEAN
148 – 2	7	7	7	21	7
153 – 1	5	5	5	15	5
153 – 2	7	7	7	21	7
109 – 1	5	5	5	15	5
109 – 2	5	5	5	15	5
Betag	7	7	7	21	7
CLG	5	5	5	15	5
TOTAL	41	41	41		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	0.01
Block	2	0.00	0.00	Infty	3.89	6.96
Treatment	6	20.57	3.43	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	20.57				

**= Highly significant CV (%) = 0.0%

Appendix Table 5. Number of days from emergence to last harvesting

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	65	65	65	195	65[a]
153 – 1	65	65	65	195	65[a]
153 – 2	65	65	65	195	65[a]
109 – 1	69	69	69	207	69[b]
109 – 2	69	69	69	207	69[b]
Betag	65	65	65	195	65[a]
CLG (CK)	69	69	69	207	69[b]
TOTAL	467	467	467		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	Infty	3.89	6.96
Treatment	6	82.28	13.71	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	82.28				

**= Highly significant CV (%) = 0.0%

Appendix Table 6. Leaflet length (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	5.15	5.13	5.05	15.33	5.11[c]
153 – 1	5.84	4.88	4.85	14.57	4.85[d]
153 – 2	5.33	5.28	5.31	15.92	5.30[b]
109 – 1	5.04	5.06	5.16	15.23	5.07[c]
109 – 2	4.92	5.0	4.91	14.83	4.94[d]
Betag	5.45	5.4	5.39	16.3	5.43[a]
CLG (CK)	4.05	4.03	4.13	12.21	4.07[e]
TOTAL	34.75	34.84	34.8		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.0005	0.0002	165.53[ns]	3.89	*6.96*
Treatment	6	3.55	0.59	220.68**	3.00	4.82
Error	12	0.03	0.002			
TOTAL	20	3.58				

** = Highly significant CV (%) = 1.04%

Appendix Table 7. Leaflet width (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	4.18	4.16	4.15	12.49	4.16[c]
153 – 1	3.37	3.35	3.38	10.1	3.36[f]
153 – 2	4.39	4.30	4.35	13.04	4.34[b]
109 – 1	3.74	3.72	3.75	11.21	3.73[d]
109 – 2	3.49	3.48	3.48	10.45	3.48[e]
Betag	4.49	4.45	4.48	13.42	4.47[a]
CLG (CK)	3.1	3.3	3.0	9.4	3.13[g]
TOTAL	26.76	26.76	26.59		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.002	0.001	0.33[ns]	3.89	6.96
Treatment	6	4.86	0.80	193.09**	3.00	4.82
Error	12	0.05	0.004			
TOTAL	20	4.91				

**= Highly significant CV (%) = 1.69%

Appendix Table 8. Number of leaves per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	311	300	256	867	289[c]
153 – 1	448	348	379	1175	391.66[a]
153 – 2	400	359	344	1103	367.66[ab]
109 – 1	414	381	321	1116	372[ab]
109 – 2	404	414	410	1228	409.33[a]
Betag	367	377	396	1140	380[ab]
CLG	330	321	340	991	330.33[cb]
TOTAL	2674	2500	2446		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	4056	2028	5.25*	3.89	6.96
Treatment	6	29709.90	4951.65	6.14**	3.00	4.82
Error	12	9670.66	805.88			
TOTAL	20	43436.57				

**= Highly significant CV (%) = 7.82%

Appendix Table 9. Tendril length (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	10	11	10	31	10.33[a]
153 – 1	7.8	7.9	7.6	23.3	7.76[d]
153 – 2	6.0	6.2	6.4	18.6	6.2[f]
109 – 1	10	9.0	10	29	9.66[b]
109 – 2	6.8	7.0	6.8	20.6	6.86[e]
Betag	8.3	8.0	8.3	24.6	8.2[cd]
CLG (CK)	8.6	8.5	8.6	25.7	8.56[c]
TOTAL	57.5	57.6	57.7		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.002	0.001	0.01[ns]	3.89	6.96
Treatment	6	38.39	6.39	49.15**	3.00	4.82
Error	12	1.55	0.13			
TOTAL	20	39.94				

**= Highly significant CV (%) = 4.36%

Appendix Table 10. Number of nodes per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	11.0	11.8	11.2	34	11.33[e]
153 – 1	18.6	18.4	18.1	55.1	18.36[a]
153 – 2	15.8	15.9	16.0	47.7	15.9[b]
109 – 1	14.8	14.6	14.2	43.6	14.53[d]
109 – 2	15.4	15.3	15.0	45.7	15.23[c]
Betag	15.8	15.8	15.5	47.1	15.7[b]
CLG (CK)	14.8	14.5	14.5	44.8	14.93[d]
TOTAL	106.2	106.3	104.5		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.29	0.14	2.95[ns]	3.89	6.96
Treatment	6	79.34	13.22	267.02**	3.00	4.82
Error	12	0.59	0.05			
TOTAL	20	80.22				

** = Highly significant CV (%) = 1.47

Appendix Table 11. Node number bearing first flower cluster

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	7.4	7.8	7.2	22.4	7.46[e]
153 – 1	12.6	12.1	12.9	37.6	12.53[b]
153 – 2	15.8	15.0	15.9	46.7	15.56[a]
109 – 1	11.8	11.6	11.4	34.4	11.46[c]
109 – 2	11.6	11.3	11.5	34.4	11.46[c]
Betag	11.4	11.8	11.2	34.4	11.46[c]
CLG (CK)	10.4	10.1	10.8	31.3	10.43[d]
TOTAL	81	79.7	80		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.07	0.03	0.31[ns]	3.89	6.96
Treatment	6	104.26	17.37	156.72**	3.00	4.82
Error	12	1.33	0.11			
TOTAL	20	105.66				

**= Highly significant CV (%) =2.88%

Appendix Table 12. Node number bearing first pod

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	7.4	7.8	7.2	22.4	7.46[e]
153 – 1	12.6	12.1	12.9	37.6	12.53[b]
153 – 2	15.8	15.0	15.9	46.7	15.56[a]
109 – 1	11.8	11.6	11.4	34.4	11.46[c]
109 – 2	11.6	11.3	11.5	34.4	11.46[c]
Betag	11.4	11.8	11.2	34.4	11.46[c]
CLG (CK)	10.4	10.5	10.8	31.3	10.43[d]
TOTAL	81	79.7	80		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.07	0.03	0.31[ns]	3.89	6.96
Treatment	6	104.25	17.37	156.72**	3.00	4.82
Error	12	1.33	0.11			
TOTAL	20	105.65				

** = Highly significant CV (%) =2.89%

Appendix Table 13. Node number bearing last pod

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	10.6	10.8	10.1	31.5	10.00[e]
153 – 1	18.0	18.3	18.7	55	10.50[d]
153 – 2	15.2	15.5	15.6	46.3	18.33[a]
109 – 1	14.6	14.8	14.0	43.4	14.46[cd]
109 – 2	14.4	15.0	15.4	44.8	14.93[b]
Betag	14.8	15.1	14.8	44.7	14.90[b]
CLG (CK)	14.6	14.8	15.0	44.4	14.80[c]
TOTAL	102.2	104.3	103.6	310.1	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.33	0.16	1.56[ns]	3.89	6.96
Treatment	6	94.52	0.10	150.02**	3.00	4.82
Error	12	1.26				
TOTAL	20	96.10				

**= Highly significant CV (%) =2.19%

Appendix Table 14. Internodes length (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	8.06	8.0	8.03	24.09	8.03[e]
153 – 1	8.79	8.75	8.76	26.3	8.76[a]
153 – 2	8.49	8.45	8.47	25.41	8.47[b]
109 – 1	8.16	8.14	8.16	24.46	8.15[d]
109 – 2	7.82	7.85	7.88	23.55	7.85[f]
Betag	8.23	8.20	8.25	24.68	8.22[c]
CLG (CK)	6.93	6.90	6.93	20.76	6.92[c]
TOTAL	56.48	56.29	56.48		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.003	0.001	3.87[ns]	3.89	6.96
Treatment	6	6.10	1.01	2842.85**	3.00	4.82
Error	12	0.004	0.0004			
TOTAL	20	6.11				

**= Highly significant CV (%) =0.23%

Appendix Table 15. Number of branches

TREATMENT	BLOCK I	II	III	TOTAL	MEAN
148 – 2	1	1	1	3	1.00[b]
153 – 1	1	1	1	3	1.00[b]
153 – 2	1	1	1	3	1.00[b]
109 – 1	1	1	1	3	1.00[b]
109 – 2	1	1	1	3	1.00[b]
Betag	1	1	1	3	1.00[b]
CLG (CK)	3	2	2	7	2.33[a]
TOTAL	1.28	1.14	1.14		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	0.01
Block	2	0.95	0.47	1.00[ns]	3.89	6.96
Treatment	6	4.57	0.76	16.00**	3.00	4.82
Error	12	0.57	0.05			
TOTAL	20	5.24				

** = Highly significant CV (%) =18.33%

Appendix Table 16. Plant height at maturity (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	88.4	90.2	91	269.6	89.86[f]
153 – 1	14.5	148	150.6	443.6	147.86[a]
153 – 2	138.6	139	136.8	414.4	138.13[b]
109 – 1	105.2	110	109.9	324.6	108.2[d]
109 – 2	103.5	108.7	105.9	318.1	106.03[d]
Betag	127.7	128.5	129	385.2	128.4[c]
CLG (CK)	91.1	93.6	94.8	279.5	93.16[f]
TOTAL	799.5	818	817.5		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	31.74	15.87	7.48**	3.89	6.96
Treatment	6	9070.79	1311.79	712.12**	3.00	4.82
Error	12	25.47	2.12			
TOTAL	20	9128.01				

**= Highly significant CV (%) =1.25%

Appendix Table 17. Number of flowers per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	8.29	7.72	8.41	24.48	8.16[c]
153 – 1	6.45	6.48	6.36	19.29	6.43[d]
153 – 2	5.10	6.80	6.50	18.40	6.13[c]
109 – 1	11.62	12.92	12.15	36.69	12.23[a]
109 – 2	9.20	9.10	9.0	27.30	9.10[b]
Betag	5.36	5.08	5.04	15.48	5.16[e]
CLG (CK)	8.33	7.89	8.11	24.33	8.11[c]
TOTAL	54.35	55.99	55.63		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.21	0.10	0.45[ns]	3.89	6.96
Treatment	6	99.27	16.54	71.28[**]	3.00	4.82
Error	12	2.78	0.23			
TOTAL	20	102.26				

[**] = Significant CV (%) =6.09%

Appendix Table 18. Number of flowers per cluster

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	2	2	2	6	2[a]
153 – 1	2	2	2	6	2[a]
153 – 2	2	2	2	6	2[a]
109 – 1	2	2	2	6	2[a]
109 – 2	2	2	2	6	2[a]
Betag	1	1	1	3	1[b]
CLG (CK)	2	2	2	6	2[a]
TOTAL	13	13	13		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	infty	3.89	6.96
Treatment	6	2.57	0.43	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	2.57				

**= High significant CV (%) = 0.00%

Appendix Table 19. Number of flowers cluster per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	3.65	4.99	4.35	12.99	4.33[c]
153 – 1	3.50	3.10	3.20	9.80	3.26[f]
153 – 2	3.60	3.40	3.20	10.20	3.40[ef]
109 – 1	6.40	6.30	6.20	18.90	6.30[a]
109 – 2	4.30	4.00	3.50	11.80	3.93[e]
Betag	5.20	5.30	5.10	15.60	5.20[b]
CLG (CK)	4.20	4.30	4.28	13.78	4.26[d]
TOTAL	30.85	31.39	29.83		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.18	0.09	0.86[ns]	3.89	6.96
Treatment	6	20.33	3.39	32.36**	3.00	4.82
Error	12	1.26	0.10			
TOTAL	20	21.76				

**= Highly significant C V (%) =7.39%

Appendix Table 20. Plant height at flowering (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	75.7	76	75.8	227.5	75.83[f]
153 – 1	112.5	112.1	112.5	337.1	112.36[a]
153 – 2	107.1	108	108	323.1	107.7[b]
109 – 1	91.3	91.8	91.7	274.8	91.6[d]
109 – 2	95.5	95.6	95.5	286.6	95.53[c]
Betag	86.7	86.8	86.7	260.2	86.53[e]
CLG (CK)	74.6	75	74.9	224.5	74.83[g]
TOTAL	643.4	645.3	645.1		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.31	0.15	3.00[ns]	3.89	6.96
Treatment	6	3773.03	628.83	12133.8**	3.00	4.82
Error	12	0.62	0.05			
TOTAL	20	3773.96				

**= Highly significant CV (%) =0.24%

Appendix Table 21. Pod length (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	7.99	7.92	7.95	23.86	7.95[c]
153 – 1	6.92	6.90	6.91	20.73	9.91[a]
153 – 2	7.28	7.25	7.26	21.79	7.26[d]
109 – 1	6.82	6.80	6.82	20.49	6.81[g]
109 – 2	6.85	6.83	6.86	20.54	6.84[f]
Betag	8.14	8.13	8.11	24.38	8.12[b]
CLG (CK)	6.94	6.92	6.95	20.81	6.93[e]
TOTAL	50.94	50.75	50.86		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.002	0.001	7.09**	3.89	6.96
Treatment	6	5.49	0.91	4988.47**	3.00	4.82
Error	12	0.002	0.0001			
TOTAL	20	5.49				

**= Highly significant CV (%) =0.14%

Appendix Table 22. Pod width (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	1.51	1.5	1.5	4.51	1.50[a]
153 – 1	1.42	1.41	1.42	4.25	1.41[d]
153 – 2	1.33	1.36	1.37	4.11	1.37[e]
109 – 1	1.34	1.33	1.34	4.01	1.33[e]
109 – 2	1.49	1.48	1.5	4.47	1.49[b]
Betag	1.44	1.44	1.45	4.33	1.41[c]
CLG (CK)	1.27	1.28	1.25	3.33	1.27[c]
TOTAL	9.85	9.3	9.36		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.29	0.01	4.04*	3.89	6.96
Treatment	6	12.26	0.01	559.65**	3.00	4.82
Error	12	0.04	0.004			
TOTAL	20	12.03				

**= Highly significant CV (%) =0.18%

Appendix Table 23. Number of pod per cluster

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	2	2	2	6	2[a]
153 – 1	2	2	2	6	2[a]
153 – 2	2	2	2	6	2[a]
109 – 1	2	2	2	6	2[a]
109 – 2	2	2	2	6	2[a]
Betag	1	1	1	3	1[b]
CLG (CK)	2	2	2	6	2[a]
TOTAL	13	13	13		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	Infty	3.89	6.96
Treatment	6	2.57	0.42	Infty	3.00	4.82
Error	12	0.00	0.00			
TOTAL	20	2.57				

**= Highly significant CV (%) =0.00%

Appendix Table 24. Number of pods per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	8.4	5.0	6.5	19.9	6.63[d]
109 – 1	11.5	12.5	12.00	36.0	12.00[a]
109 – 2	8.0	9.0	7.0	24.0	8.00[b]
153 – 1	4.2	6.2	7.3	17.7	5.90[e]
153 – 2	5.6	4.6	4.2	14.4	4.80[f]
Betag	4.1	4.8	5.3	14.2	4.73[fg]
CLG (ck)	8.0	7.0	6.0	21.0	7.00[c]
TOTAL	49.8	49.1	48.3		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.16	0.08	0.06[ns]	3.89	6.96
Treatment	6	111.97	18.66	13.33**	3.00	4.82
Error	12	16.85	1.40			
TOTAL	20	138.98				

**= Highly significant CV (%) =16.90 %

Appendix Table 25. Percent pod set per plant

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	84.9	85	85.5	255.4	85.13 [c]
109 – 1	87.6	87.5	87.7	262.7	87.56 [b]
109 – 2	84.9	85	85	254.9	84.96 [c]
153 – 1	83.6	83.3	83.5	250.9	83.63 [e]
153 – 2	89.1	90	89.3	268.9	89.63 [a]
Betag	84.3	84.5	84.6	25.4	84.46 [c]
CLG (ck)	89.6	89.9	89.5	269	89.66 [a]
TOTAL	604	605.7	605.5		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.25	0.12	2.47^{ns}	6.89	6.93
Treatment	6	112.58	18.77	375.4**	3.00	4.82
Error	12	0.60	0.05			
TOTAL	20	113.43				

**= Highly significant CV (%) =0.25 %

Appendix Table 26. Weight of marketable fresh pod yield per plant (kg/5m^2)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	1.80	1.78	1.70	5.28	1.76 ^{c}
109 – 1	1.48	1.59	1.55	4.62	1.54 ^{d}
109 – 2	1.84	1.77	1.82	5.43	1.81 ^{bc}
153 – 1	1.82	1.83	1.81	5.46	1.82 ^{b}
153 – 2	1.72	1.95	1.76	5.43	1.81 ^{bc}
Betag	2.04	1.97	2.05	6.06	2.02 ^{a}
CLG (ck)	1.42	1.69	1.27	4.38	1.46 ^{e}
TOTAL	12.12	12.58	11.96		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.04	0.02	2.5^{ns}	3.89	6.93
Treatment	6	0.65	0.11	13.75**	3.00	4.82
Error	12	0.10	0.008			
TOTAL	20	0.79				

**= Highly significant CV (%) =5.11%

Appendix Table 27. Weight of non-marketable fresh pods yield per plant (kg/5m^2)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	0.31	0.55	0.82	1.68	0.560^{bc}
109 – 1	0.42	0.35	0.81	1.58	0.520^{d}
109 – 2	0.55	0.44	0.72	1.71	0.570^{b}
153 – 1	0.61	0.61	0.55	1.77	0.540^{c}
153 – 2	0.80	0.65	0.49	1.94	0.64 ^{a}
Betag	0.53	0.45	0.58	1.56	0.520^{d}
CLG (ck)	0.31	0.35	0.64	1.03	0.430^{e}
TOTAL	3.53	3.4	4.61		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.12	0.06	2.5^{ns}	3.89	6.93
Treatment	6	0.8	0.013	0.54^{ns}	3.00	4.82
Error	12	0.29	0.024			
TOTAL	20	0.49				

ns = Not significant CV (%) = 28.68%

Appendix Table 28. Total yield per plot (kg/5m^2)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
148 – 2	2.30	2.34	2.32	6.96	2.32 [d]
109 – 1	2.07	2.08	2.03	36.18	2.06 [e]
109 – 2	2.43	2.40	2.34	7.17	2.39 [c]
153 – 1	2.44	2.39	2.40	7.23	2.41 [c]
153 – 2	2.40	2.47	2.48	7.35	2.45 [b]
Betag	2.55	2.56	2.51	7.62	2.54 [a]
CLG (ck)	1.89	1.88	1.95	5.72	1.90 [f]
TOTAL	16.08	16.12	16.03		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	0.00	0.00	0.00	3.89	6.93
Treatment	6	0.94	0.16	160**	3.00	4.82
Error	12	0.02	0.001			
TOTAL	20	0.96				

**= Highly significant CV (%) = 1.37%