BIBLIOGRAPHY

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Adviser: Prof. Guerzon A. Payangdo, MSc

ABSTRACT

On-farm evaluation of potential pole snap bean varieties was conducted at Gusaran, Kabayan, Benguet to determine the pole snap bean variety suited in Gusaran, Kabayan, Benguet and to determine the economic benefit of planting different pole snap bean varieties.

The study revealed that Alno, Violeta and Farmer's variety took five days to pod setting. Patig, Taichung and Blue Lake took six days. Percent pod setting among the six varieties ranged from 46-64% per cluster.

The six varieties of pole snap bean significantly differed in their yielding potential. Violeta and Blue Lake performed significantly better than the other varieties in pod clusters per plant, pods per plant and number and weight of marketable pods.

The highest yield and highest return on cash expense (ROCE) was obtained from Blue Lake and Taichung.

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INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.) is grown in many parts of the world under a wide range of condition. This plant thrives well in cool medium to high altitude in tropical countries. It is an annual crop adapted to a wide variety of soil.

In the Philippines, snap bean is cultivated mostly in the highlands of the Cordillera. Two types of snap bean are commercially grown in the province of Benguet. The vine type or pole snap bean and bush type or sitting snap bean. Since snap bean production is one of the main sources of income of the farmers in the highlands, its production should be increased. This could be attained by selecting the variety to be grown in the area and practicing proper cultural management. Currently, only progressive farmers know the varieties of snap bean that they are planting. Because of this, no comprehensive recommendation based on the farmers experience can be attained. In this case, there is a need to evaluate the different promising line of snap bean to identify the lines that is most suited in the growing area, particularly in Benguet and Mountain Province.

Aside from the benefits as money-making crop in the country, snap bean is an excellent source of proteins and vitamins. It partly contributes a solution to the malnutrition problem in the country because of its food nutrients. Its protein content is almost comparable with fish, eggs, meat and rice.

In addition to its role in alleviating malnutrition of the people and its potential as money-making legume in the highlands, snap bean is also beneficial to the soil. As a leguminous crop, its roots aided by bacteria have the capacity to fix nitrogen from the air making the soil fertility level higher than when planted with non-leguminous crop.

Increasing the production of pole snap beans helps in the improvement of the physical and chemical characteristics of the soil.

The objectives of the study were to:

1. determine the pole snap bean variety best suited in Gusaran, Kabayan, Benguet condition based on yield and resistance to insects and diseases; and

2. determine the economic benefit of planting different pole snap bean varieties.

This study was conducted at Gusaran, Kabayan, Benguet from November to March 2007.

REVIEW OF LITERATURE

Snap beans (*Phaseolus vulgaris* L.*)* species belonging to the family leguminosae is glabrious, dwarf and climbing plant. The performance of snap bean plants grown from seeds produced from different plant portions at different stages of maturity (Kudan, 1999). The results of the study of Bao-an (2000) showed that the snap bean cultivar stone hill (Patig) developed six nodes flower buds appeared afterwhich took 25 days for the petals to develop fully from these flower buds (petal break). The percentage of pod set was higher at 5th base portion followed by middle had 4 to 6 flowers and the upper portion had six to eight flowers per cluster. According to Kudan (1999), in attaining a higher percentage of pod set (62.5%) beans will be planted during October to November while planting in March to May will obtain 30-40 pod percentage. The number of pod yield of a variety determines the number of flowers per cluster. The more flowers a variety have the more pods were realized. The number of pods should always be considered in selecting a variety to plant, as it is associated to higher pod yield. Atos (1997) evaluated the growth and yield performance of five pole snap bean cultivars. Results showed that stone hill (patig) and blue lake prime pak yielded the most number of pod per cluster. The result could be attributed to high yielding potential of the cultivars.

According to Regmi (1990), variety evaluation gathers data on plant character, yield and pod quality, moreover Shresta (1989) stressed that to determine high yielding varieties, varietal evaluation is important because different varieties have different potential. The fresh pod of snap bean or any vegetable legumes are considered marketable when they are smooth, tender and free from pest and insect damages (Gonzales, 1983). Some may be fleshy or rounded and other slender or flat (Swiader et.

al., 2002) The following inflorescence usually takes a long period to develop (Perez, 1983). An average of 4-5 seeds per pod with each weighing 350-620 mg. Snap bean pods are generally 3 to 8 inches long and 0.25 to 0.75 inch narrow.

Varietal evaluation gathers data on plant character, yield performance and pod quality, hence we can obtain high yielding and improved cultivars that are known to plant important role in boosting production (Regmi, 1990). In addition, Cagampang and Lantican (1977) observed that the choice of variety is important, he further suggested that in many instances, the wise use of improved variety has resulted to tremendous increase in yield. Moreover, Bautista and Mabesa (1977) stressed that choosing the right variety will minimize problems associated with water and fertilizer management so that high yield will be obtained. On the other hand, growing the wrong variety may mean crop failure due to low yield and pest infestation.

Yield performance of any variety is affected by environmental conditions such as soil condition, climate and incidence of pest in snap bean production. Common blight is a serious disease of snap bean throughout the world. So far, no effective and economical fungicide has been found to control the diseases (Villareal, 1969). He recommended some control measures such as the use of disease-free seeds, crop rotation, deep plowing of the plant debris and use of tolerant cultivars.

In seed production, Ap-apid (1991) found out that the wider the spacing between hills, the heavier the marketable seed produced per plant. The lightest were produced from plants with 10 cm distance due to high competition for light and nutrients among plant per unit area. Similarly, Ingles (1990) found out that density of two seeds per hill at a distance of 20 cm to 30 cm between hills yielded the heaviest seeds per plot.

Irrigation is an essential requirement in the farm when rainfall is not secured without the selection of seeds, application of adequate fertilizer, insect pest and disease control and the practice improved cultural management could ensure production of crops with maximum economic returns (Acquision, 1996).

Hampton (1987) explained that a number of factors have been used to estimate the correct point at which seed is harvestable. This includes seed consistency, seed shattering, crop, color, leaf senescence and moisture content. He further stressed that basing harvesting timing on seed consistency over a whole crop especially when flowering have been spread over a period from only few days to several weeks. The later situation being a common characteristics of intermediate legumes. However, he also mentioned that estimating shattering loss in a crop is often a poor indicator of harvest timing.

MATERIALS AND METHODS

An area of 200 m^2 was prepared into 18 raised beds measuring 1m x 10 m and divided into three blocks to accommodate the six treatments following the randomized complete block design (RCBD). The seeds were sown in a double row following a distance of 25 cm between hills and rows. To ensure optimum growth yield, proper trellising crop protection was done two days after emergence and employed to all the treatments just after the emergency up to the second to last harvest.

The seeds of six varieties of snap beans that served as treatments in this study were obtained from different sources, which are as follows:

CODE	VARIETY	SOURCE
V_1	Alno	BSU-IPBHCRS
V_2	Blue lake	BSU
V_3	Patig	BSU
V_4	Farmers (Check variety)	Kabayan
V_5	Violeta	BSU-IPBHCRS
V_6	Taichung	BSU-IPBHCRS

The data gathered were the following:

1. Maturity

a. Days to emergence. This was gathered when 75% of plants per plot had emerged.

b. Days from planting to flowering. This was determined by counting the days from planting up to the time when 50% of the plants per plot started to produce flowers.

c. Days from planting to first harvest. This was recorded by counting the days from planting to first harvest.

d. Days from planting to last harvest. This was recorded by counting the days from planting to the last harvesting.

2. Growth parameters

a. Number of flowers per cluster. The number of flowers per cluster that were developed per plant was recorded from five sample clusters per plot (treatment).

b. Number of days to pod setting. This was recorded by counting the days when 50% of the flowers break up and pod measured 1 inch long.

c. Number of pods per cluster. This was recorded by counting the number of pods per cluster per plant.

d. Number of pod clusters per plant. This was recorded by counting the number of pod clusters per plant.

e. Percentage pod set per cluster (%). This was determined using the data in number 4 and 6 as follows:

$$\text{Percentage Pod (\%)} = \frac{\text{Total number of pods per cluster}}{\text{Total number of flower per cluster}} \times 100$$

f. Percent abortion (pod fall). This was obtained by getting the difference between 100% pod setting per treatment and the percent pot set per flower cluster that was obtained in data number 7.

g. Number of pods per plant. This was gathered using the following formula.

$$\text{Number of pods per plant} = \frac{\text{Total number of pods harvested per plot}}{\text{Total number of plants harvested per plot}}$$

h. Length of pod at harvest (cm). Ten random sample pods were obtained per treatment and pod length was measured from pedicel end to distal end using a foot ruler.

i. Width of pod at harvest (cm). This was measured from the ten samples used in getting the length of pod from its middle portion using foot ruler.

4. Yield and yield components

a. Number and weight of marketable pods per treatment (kg). Marketable pods that are free from disease and insect damage were counted and weighed.

b. Number and weight of non-marketable pods per treatment (kg). Non-marketable pods that were diseased, damaged or deformed were also counted and weighed in kg using weighing scale throughout the harvesting duration.

c. Number of harvesting per treatment. This was recorded by counting the number of harvest per treatment.

d. Total yield per plot (kg/plot). The total weight of marketable and non-marketable pods per plot were computed at the end of the harvesting season.

e. Computed yield per hectare (t/ha). This was computed based on the pod yield per plot in kg/10m^2 multiplied by 1,000 which is a factor to covert yield in kg/10m^2 to t/ha.

$$\text{Yield per hectare (t/ha)} = \frac{\text{Total yield per plot (kg)}}{10\text{m}^2} \times 10{,}000\ \text{m}^2$$

Where 2.0 was a factor used to convert yield in kg/5 m^2 into yield per hectare in t/ha.

5. Other data

a. Return on cash expense (ROCE). Production cost, gross net income and ROCE were determined. ROCE was computed as follows:

$$ROCE = \frac{\text{Gross sales} - \text{total expenses}}{\text{Total expenses}} \times 100$$

RESULTS AND DISCUSSION

Number of Days to Emergence and Flowering

It was observed that the six varieties emerged from seven to eight days under Gusaran, Kabayan condition with no significant differences.

In terms of days to flowering, Table 1 shows that Violeta flowered at 71 days from planting, which was the earliest among the varieties but was comparable with the rest of the varieties. Differences on the days to flowering could be attributed to the varietal characteristics.

Number of Days to Pod Setting

Significant differences on the number of days to pod setting were observed among the six varieties of pole snap bean evaluated (Table 1). Patig, Taichung and Blue Lake gave numerous pods and also statistically comparable with the other varieties. This could be the effect of good crop maintenance.

Number of Days to Harvest

No significant differences were observed on the days to first harvest. Varieties Alno, Violeta and Taichung were harvested 76 days after planting while Patig, Farmers, and Blue Lake were harvested 77 days after planting.

As to last harvest, there were significant differences noted among the six varieties. Patig and Blue Lake attained their last harvest in 104 days while Alno attained its last harvest in 98 days, however, the result was comparable with the other varieties except for Violeta which was harvested earlier.

Table 1. Number of days to emergence, flowering, pod setting, first and last harvesting of the six varieties of snap bean

VARIETY	DAYS TO:				
	EMERGENCE	FLOWERING	POD SETTING	FIRST HARVESTING	LAST HARVESTING
Alno	7	73[ab]	5[ab]	76	98[b]
Patig	8	73[ab]	6[a]	77	104[a]
Violeta	8	71[a]	5[ab]	76	98[b]
Taichung	8	73[ab]	6[a]	76	102[ab]
Farmers	8	74[ab]	5[ab]	77	99[ab]
Blue Lake	7	73[ab]	6[a]	77	104[a]
CV (%)	5.62	1.60	9.84	1.08	2.80

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

Number of Pod Clusters Per Plant

The number of pod clusters per plant is presented in Table 2. Violeta produced significantly the highest number of cluster per plant and which were comparable with the rest of the varieties.

Number of Flowers and Pods Per Cluster

As to number of flowers per cluster, no significant differences were obtained. On the pods per cluster, Violeta significantly had the highest number of pods per cluster (3) and it was comparable with the other five varieties.

Table 2. Number of clusters per plant, flowers and pods per cluster of the six varieties of pole snap bean

VARIETY	NUMBER OF:		
	POD CLUSTERS PER PLANT	FLOWERS PER CLUSTER	PODS PER CLUSTER
Alno	20[b]	4	2[ab]
Patig	21[ab]	5	2[ab]
Violeta	23[a]	5	3[a]
Taichung	22[ab]	5	2[ab]
Farmer	20[b]	4	2[ab]
Blue Lake	21[ab]	4	2[ab]
CV (%)	5.02	14.4	22.44

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

Percentage Pod Set Per Cluster and Percent of Pod Abortion

Statistical analysis showed no significant differences observed on the percentage pod set and abortion per cluster among the six varieties of the pole snap bean (Table 3). Violeta had the highest percent pod per cluster with 64%, followed by Blue Lake.

Number of Pods Per Plant

The number of pods per plant is also presented in Table 3. Violeta significantly produced the highest number of pods per plant (17) followed by Blue Lake with 16 pods per plant but was comparable to the other varieties except Patig which registered the lowest pods per plant (12).

Pod Length and Width

There were significant differences observed on the pod length of the six varieties of snap bean tested (Table 3). Violeta had the longest pod with 17 cm., followed by Patig and Taichung. The shortest was noted from Farmers seeds.

As to pod width, significant differences were observed such that Blue Lake variety was the widest at 1.54 cm followed by Patig. The narrowest was noted from the rest of the varieties.

Number of Marketable and Non-marketable Pods

As to the number of marketable pods (Table 4), Violeta significantly had the most marketable pods with 1,193 and was statistically similar with Blue lake with a mean of 1,179 marketable pods. The least of marketable pods was taken from Patig.

Table 3. Percent pod set per cluster, pod abortion, number of pods per plant, pod length and pod width of the six varieties of pole snap bean

VARIETY	SET PER CLUSTER (%)	ABORTION (%)	POD PER PLANT	LENGTH (cm)	WIDTH (cm)
Alno	56[a]	20[ab]	14[ab]	14[c]	1.16[c]
Patig	53[ab]	23[ab]	12[b]	15[b]	1.43[b]
Violeta	64[a]	20[ab]	17[a]	17[a]	1.15[c]
Taichung	46[b]	26[a]	14[ab]	15[b]	1.17[c]
Farmers	53[ab]	20[ab]	14[ab]	13[d]	1.13[c]
Blue Lake	61[a]	16[b]	16[a]	14[c]	1.54[a]
CV (%)	13.27	16.56	3.42	1.16	3.42

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

As to non-marketable pods, Alno had the highest which is also comparable with Blue Lake, Farmers and Patig. The lowest was obtained from Violeta and Taichung.

Weight of Marketable and Non-marketable Pods Per Plot

Pods are considered marketable when they are straight, tender and free from insect pest damage and disease. The non-marketable pods were diseased, damaged or malformed.

Significant differences in weight of marketable fresh pods of the six varieties were noted. Violeta had the highest yield weight of 10 kg/5m^2 followed by the other varieties. As to non-marketable pods, no significant differences were observed

Table 4. Number and weight of marketable and non-marketable pods of the six varieties of pole snap beans

VARIETY	NUMBER		WEIGHT	
	MARKETABLE PODS	NON-MARKETABLE PODS	MARKETABLE PODS (kg/10m^2)	NON-MARKETABLE PODS (kg/10m^2)
Alno	860^{bc}	327^{a}	6^{b}	1.07
Patig	756^{c}	241^{ab}	6^{b}	1.06
Violeta	1,193^{a}	180^{b}	10^{a}	0.76
Taichung	996^{abc}	186^{b}	7^{b}	0.80
Farmers	949^{abc}	203^{ab}	6^{b}	0.87
Blue Lake	1,079^{ab}	242^{ab}	8^{b}	1.09
CV (%)	14.71	19.66	16.81	23.18

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

Total Yield Per Plot and Per Hectare

It was noted that Violeta had the highest marketable and non-marketable pods per plot and per hectare followed by the other varieties rated under marketable and non-marketable pods (Table 5). The significant differences could be due to the effect of varieties.

Return on Cash Expense (ROCE)

Blue Lake had the highest computed ROCE followed by Taichung (Table 5).

Table 5. Total yield per plot and per hectare and ROCE of the six varieties of pole snap bean

VARIETY	YIELD		
	PER PLOT ($kg/10m^2$)	PER HECTARE (t/ha)	ROCE (%)
Alno	7.66^b	7.66^b	39.41
Patig	7.06^b	7.06^b	27.06
Violeta	11.59^a	11.59^a	12.94
Taichung	7.80^b	7.80^b	48.23
Farmers	7.03^b	7.03^b	30.55
Blue Lake	9.11^b	9.11^b	69.76

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

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

The study aimed to evaluate the six varieties of pole snap beans and to identify the highest yielding variety of snap bean. This was conducted at Gusaran, Kabayan, Benguet from November 2006 to March 2007. Violeta flowered earlier at 71 days after planting (DAP) than the other varieties. It also produced the highest number of cluster per plant (23), number of flowers per cluster (6) and pod set per cluster (4) than the rest of the varieties. Farmer's variety produced the lowest number of flower cluster per plant (20), number of flower per cluster (4), and pod set per cluster (2). Violeta took only five days to set pod after flowering. It had the highest percent pod set per cluster with 65% while Taichung recorded the lowest percent pod set per cluster (46%). Violeta, Alno and Taichung were the first to be harvested at 76 days after planting. Patig and Blue Lake were the last harvested at 106 days after planting. Violeta produced the highest number of pods per plant (51) and marketable pod per $10m^2$ plot while Patig produced the lowest number of pods per plant (37).

Violeta produced the heaviest weight of marketable pods of 14.83. It also gave the highest yield per plot and per hectare (11.59 kg/10 m^2). Violeta significantly produced the longest pods of 17 cm while Farmers recorded the shortest pod length. Blue Lake produced significantly the widest pods (1.54 cm) while Farmers had the narrowest pods.

Blue Lake produced the highest return on cash expense (ROCE) 69.76%.

Conclusion

Violeta, Blue lake and Taichung were the highest yielders. High ROCE was obtained from Blue Lake and Taichung.

Recommendation

Blue lake and Taichung are recommended for farmers growing pole snap bean at Gusaran, Kabayan, Benguet condition.

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APPENDICES

Appendix Table 1. Days to emergence of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	7	7	8	22	7.34
Patig	8	8	8	24	8.00
Violeta	8	8	8	24	8.00
Taichung	8	8	8	24	8.00
Farmers	8	7	8	23	7.67
Blue Lake	7	8	7	22	7.34
TOTAL	46	46	47	139	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.111	0.055	1.71^{ns}	3.33	5.64
Variety	5	1.611	0.322			
Error	10	1.888	0.188			
TOTAL	17	3.610				

ns – not significant

Coefficient of variation (CV) = 5.62%

Appendix Table 2. Days from planting to flowering of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	75	73	73	227	73.66
Patig	74	72	75	221	73.66
Violeta	72	71	71	214	71.33
Taichung	73	74	74	221	73.66
Farmers	74	74	75	223	74.33
Blue Lake	71	74	74	219	73.00
TOTAL	439	438	442	1,325	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	1.444	0.722	2.34^{ns}	3.33	5.64
Variety	5	16.277	3.255			
Error	10	13.888	1.388			
TOTAL	17	31.611				

ns – not significant Coefficient of variation (CV) = 1.60%

Appendix Table 3. Number of clusters per plant of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	23	20	19	62	20.66
Patig	22	22	20	64	21.33
Violeta	25	23	22	70	23.33
Taichung	23	21	22	66	22.00
Farmers	20	19	21	60	20.00
Blue Lake	22	21	22	65	21.66
TOTAL	140	126	126	387	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	9.000	4.500	3.40*	3.33	5.64
Variety	5	19.833	3.966			
Error	10	11.666	1.166			
TOTAL	17	40.500				

* – significant Coefficient of variation (CV) = 5.02%

Appendix Table 4. Number of flower per cluster of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	5	5	4	14	4.66
Patig	5	4	6	15	5.00
Violeta	6	5	6	17	5.66
Taichung	5	6	6	17	5.66
Farmers	4	4	5	13	4.33
Blue Lake	4	5	4	13	4.33
TOTAL	29	29	31	89	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.444	0.222	2.30^{ns}	3.33	5.64
Variety	5	5.611	1.122			
Error	10	4.888	0.488			
TOTAL	17	10.944				

ns – not significant Coefficient of variation (CV) = 14.14%

Appendix Table 5. Number of pod set per cluster of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	3	3	2	8	2.66
Patig	3	2	3	8	2.66
Violeta	4	3	4	11	3.66
Taichung	2	3	3	8	2.66
Farmers	2	2	3	7	2.33
Blue Lake	3	3	2	8	2.66
TOTAL	17	16	17	50	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.111	0.055	1.60^{ns}	3.33	5.64
Variety	5	3.111	0.622			
Error	10	3.888	0.388			
TOTAL	17	7.111				

ns – not significant Coefficient of variation (CV) = 22.44%

Appendix Table 6. Number of days to pod setting of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	5	6	5	16	5.33
Patig	6	7	7	20	6.66
Violeta	6	5	6	16	5.33
Taichung	6	7	6	19	6.33
Farmers	6	5	6	16	5.33
Blue Lake	6	7	7	20	6.66
TOTAL	35	37	37	107	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.444	0.222	2.78^{ns}	3.33	5.64
Variety	5	4.944	0.988			
Error	10	3.555	0.355			
TOTAL	17	8.944				

ns – not significant Coefficient of variation (CV) = 9.84%

Appendix Table 7. Percentage pod set per cluster of six varieties of pole snap beans (%)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	60	60	50	170	56.66
Patig	60	50	50	160	53.33
Violeta	67	60	67	194	64.66
Taichung	40	50	50	140	46.67
Farmers	50	50	60	160	53.33
Blue Lake	75	60	50	185	61.66
TOTAL	352	330	325	1,009	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	62.111	31.055	2.26^{ns}	3.33	5.64
Variety	5	626.944	125.388			
Error	10	553.888	55.388			
TOTAL	17	1,242.944				

ns – not significant Coefficient of variation (CV) = 13.27%

Appendix Table 8. Percentage abortion (pod fall) of six varieties of pole snap beans (%)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	20	20	20	60	20.00
Patig	20	20	30	70	23.33
Violeta	20	20	20	60	20.00
Taichung	20	30	30	80	26.66
Farmers	20	20	20	60	20.00
Blue Lake	10	20	20	50	16.66
TOTAL	110	130	140	380	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	77.777	38.888	2.91^{ns}	3.33	5.64
Variety	5	177.777	35.555			
Error	10	122.222	12.222			
TOTAL	17	377.777				

ns – not significant Coefficient of variation (CV) = 16.56%

Appendix Table 9. Days from planting to first harvest of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	76	77	77	230	76.66
Patig	78	77	78	233	77.66
Violeta	76	76	77	229	76.33
Taichung	76	78	76	230	76.66
Farmers	78	76	77	231	77.00
Blue Lake	78	77	78	232	77.33
TOTAL	462	461	463	1,385	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.333	0.166	1.33^{ns}	3.33	5.64
Variety	5	4.666	0.933			
Error	10	7.000	0.700			
TOTAL	17	12.000				

ns – not significant Coefficient of variation (CV) = 1.08%

Appendix Table 10. Days from planting to last harvest of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	96	101	97	294	98.00
Patig	102	106	106	314	104.66
Violeta	100	96	100	296	98.66
Taichung	101	106	100	307	102.33
Farmers	102	96	101	299	99.66
Blue Lake	102	106	106	314	104.66
TOTAL	603	611	610	1,826	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	6.333	3.166	3.28^{ns}	3.33	5.64
Variety	5	132.666	26.533			
Error	10	81.000	8.100			
TOTAL	17	220.000				

ns – not significant Coefficient of variation (CV) = 2.80%

Appendix Table 11. Number of pods per plant of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	14.08	12.61	17.81	44.50	14.83
Patig	13.36	10.76	13.27	51.48	14.46
Violeta	19.83	15.18	16.47	43.56	17.16
Taichung	12.17	14.33	17.06	43.21	14.52
Farmers	12.02	14.51	16.68	49.53	14.40
Blue Lake	14.32	17.70	17.51	272.67	16.51
TOTAL	85.78	85.09	98.80		

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	19.886	9.943	2.07^{ns}	3.33	5.64
Variety	5	41.977	8.395			
Error	10	40.463	4.046			
TOTAL	17	102.327				

ns – not significant Coefficient of variation (CV) = 13.42%

Appendix Table 12. Number of marketable pods per treatment of six varieties of pole snap bean (kg)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	828	720	1,032	2,580	860
Patig	826	605	827	2,268	756
Violeta	1,366	1,091	1,123	3,580	1,193.67
Taichung	827	981	1,182	2,990	996.67
Farmers	742	991	1,116	2,849	949.67
Blue Lake	977	1,150	1,110	3,237	1,079
TOTAL	5,576	5,538	6,390	17,504	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	77219.111	38609.555	3.54*	3.33	5.64
Variety	5	3622.444	72446.088			
Error	10	204750.888	20475.088			
TOTAL	17	644200.444				

* – significant

Coefficient of variation (CV) = 14.71%

Appendix Table 13. Number of non-marketable pods per treatment of six varieties of pole snap beans (kg)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	299	289	393	981	327
Patig	233	256	235	742	241.33
Violeta	221	124	195	540	180
Taichung	147	229	183	559	186.33
Farmers	220	170	219	609	203
Blue Lake	169	266	291	726	242
TOTAL	1289	1334	1516	4157	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	4815.444	2407.722			
Variety	5	44451.611	8890.322	4.35*	3.33	5.64
Error	10	20453.888	2045.388			
TOTAL	17	69720.944				

* - significant

Coefficient of variation (CV) = 19.66%

Appendix Table 14. Weight of marketable pods per treatment of six varieties of pole snap beans (kg/10m^2)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	6.75	6.50	6.50	19.75	6.58
Patig	6.75	4.75	6.50	18.00	6.00
Violeta	13.25	9.50	9.75	32.50	10.83
Taichung	6.25	7.00	7.75	21.00	7.00
Farmers	4.75	7.00	6.75	18.50	6.167
Blue Lake	7.25	8.00	8.80	24.05	8.02
TOTAL	45.00	42.75	46.05	133.80	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.947	0.473			
Variety	5	49.408	9.881	6.32**	3.33	5.64
Error	10	15.629	1.562			
TOTAL	17	65.985				

** - highly significant Coefficient of variation (CV) = 16.81%

Appendix Table 15. Weight of non-marketable pods per treatment of six varieties of pole snap beans (kg/10m^2)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	0.95	1.25	1.03	3.23	1.07
Patig	1.08	1.18	0.93	3.19	1.06
Violeta	0.98	0.45	0.85	2.28	0.76
Taichung	0.62	1.00	0.78	2.40	0.80
Farmers	0.95	0.92	0.74	2.61	0.87
Blue Lake	0.75	1.20	1.33	3.28	1.09
TOTAL	5.33	6.00	5.66	16.99	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.037	0.018			
Variety	5	0.346	0.068	1.43^{ns}	3.33	5.64
Error	10	0.478	0.047			
TOTAL	17	0.859				

ns – not signficant Coefficient of variation (CV) = 23.18%

Appendix Table 16. Total yield per plot of six varieties of pole snap beans (kg/10m^2)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	7.70	7.75	7.53	22.98	7.66
Patig	7.83	5.93	7.43	21.19	7.06
Violeta	14.23	9.95	10.6	34.78	11.59
Taichung	6.87	8.00	8.53	23.40	7.80
Farmers	5.70	7.92	7.49	21.11	7.04
Blue Lake	8.00	9.20	10.13	27.33	9.11
TOTAL	50.33	48.75	51.71	150.79	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.731	0.365			
Variety	5	45.753	9.150	4.96*	3.33	5.64
Error	10	18.432	1.843			
TOTAL	17	64.917				

* - significant Coefficient of variation (CV) = 16.20%

Appendix Table 17. Total yield per hectare of six varieties of pole snap beans (t/ha)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	7.70	7.75	7.53	22.98	7.66
Patig	7.83	5.93	7.43	21.19	7.06
Violeta	14.23	9.95	10.6	34.78	11.59
Taichung	6.87	8.00	8.53	23.40	7.80
Farmers	5.70	7.92	7.49	21.11	7.04
Blue Lake	8.00	9.20	10.13	27.33	9.11
TOTAL	50.33	48.75	51.71	150.79	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.731	0.365			
Variety	5	45.753	9.150	4.96*	3.33	5.64
Error	10	18.432	1.843			
TOTAL	17	64.917				

* - significant Coefficient of variation (CV) = 16.20%

Appendix Table 18. Length of pod at harvest of six varieties of pole snap beans (cm)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	14.04	14.07	14.06	42.17	14.05
Patig	15.76	15.78	15.80	47.34	15.78
Violeta	17.60	17.59	17.61	52.80	17.60
Taichung	15.70	15.71	15.70	47.11	15.70
Farmers	13.82	13.81	13.83	41.46	13.82
Blue Lake	14.80	14.10	14.90	43.80	14.60
TOTAL	91.72	91.06	91.90	274.68	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.065	0.032			
Variety	5	29.699	5.939	187.65**	3.33	5.64
Error	10	0.316	0.031			
TOTAL	17	30.081				

** - highly significant Coefficient of variation (CV) = 1.16%

Appendix Table 19. Width of pod at harvest of six varieties of pole snap beans (cm)

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	1.2	1.2	1.10	3.5	1.16
Patig	1.5	1.4	1.4	4.3	1.43
Violeta	1.14	1.15	1.16	3.45	1.15
Taichung	1.18	1.16	1.18	3.52	1.17
Farmers	1.10	1.2	1.1	3.4	1.13
Blue Lake	1.54	1.52	1.56	4.62	1.54
TOTAL	7.67	7.63	7.5	22.79	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.002	0.001			
Variety	5	0.457	0.091	48.55**	3.33	5.64
Error	10	0.018	0.001			
TOTAL	17	0.479				

** - highly significant Coefficient of variation (CV) = 3.42%

Appendix Table 20. Number of harvest per treatment of six varieties of pole snap beans

VARIETY	BLOCK				
	I	II	III	TOTAL	MEAN
Alno	5	6	5	16	5.33
Patig	6	5	5	16	5.33
Violeta	6	5	5	16	5.33
Taichung	6	5	6	17	5.67
Farmers	5	5	6	16	5.33
Blue Lake	6	5	5	16	5.33
TOTAL	34	31	32	97	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULAR F	
					0.05	0.01
Block	2	0.777	0.388			
Variety	5	0.277	0.055	1.17^{ns}	3.33	5.64
Error	10	3.222	0.322			
TOTAL	17	4.277				

ns – not significant Coefficient of variation (CV) = 10.53%