BIBLIOGRAPHY

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ABSTRACT

The study aimed to determine; the agronomic characters of different bush snap bean varieties grown organically, the best performing variety of bush snap bean in terms of growth, yield and resistance of pest and diseases under organic production and the economic benefit of planting different bush snap bean varieties under organic production.

The nine snap bean varieties significantly varied in their maturity, height at 30 and 77 DAP, number of branches, number of seeds per pod, weight of 200 seeds, number and weight of marketable seeds and total yield.

Contender and "Lipstican" were earliest to produce pods. HAB 323 produced the most seeds per pod. "Lipstican" significantly produced the highest seed yield. HAB 19 had the highest return on cash expense. HAB 323, HAB 19, Contender and "Lipstican", Green Crop are the best yielders and most profitable to grow under organic production at Balili, La Trinidad, Benguet.

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INTRODUCTION

Snap bean (*Phaseolus vulgaris L.*), a vegetable legume, commonly source of plant protein for human diet as well as feed supplement for animals. It is also rich in vitamins and soluble carbohydrates. Snap bean thrives well in cool medium to high altitude in tropical countries (World Book Encyclopedia, 1991).

According to surveys, Benguet farmers commonly practice monocropping of snap bean under conventional farming with the intensive use of chemical and synthetic fertilizers. Such practices meant to increase production contributed to several problems like soil degradation, water contamination, air pollution, resistance to insects and diseases and further reduction in yield. Due to these problems alternative farming is important to consider. One of these is the production without the use of synthetic fertilizers and pesticides and practice of crop diversity. These practices are all embraced in organic farming.

In organic farming, the use of resistant varieties against diseases and insects that would minimize the use of synthetic fungicides and insecticides. It is, therefore, important to introduce resistant and high yielding snap bean varieties adapted to organic production.

According to Colting (1994), application of organic fertilizers affects favorable changes in soil properties. In general, the pH and organic matter content of the soil increased after harvesting of the plants. This indicates that organic farming allows the production of crops while enhancing soil productivity.

The result of the study will provide information to farmers in selecting snap bean varieties, which are high yielding, insect and disease resistant and adapted to organic production.

The objectives of the study were to:

1. determine the agronomic characters of different bush snap bean varieties grown organically;
2. determine the best performing variety of bush snap bean in terms of growth, seed yield and resistance to pest and disease under organic production; and
3. determine the economic benefit of planting different bush snap bean varieties under organic production.

The study was conducted at the BSU Experimental Station Balili, La Trinidad, Benguet form October 2006 to January 2007.

REVIEW OF LITERATURE

Organic Farming Defined

According to Sullivan (2003), organic farming system avoid using synthetic fertilizers, pesticides and growth regulators, and relies on crop rotations, crop residues, animal manures, legumes, green manuring, off-farm waste, mechanical cultivation, mineral bearing rocks and biological pest control to maintain the health of the soil, plant nutrient supply and minimize insect, weeds and disease.

Components of Organic Farming

Use of organic fertilizers. Since commercial are petroleum – based, the make the soil acidic and hard. As a result, beneficial microbes cannot thrive and the natural fertility of the soil is lost. On the other hand, organic fertilizers improve drainage and aeration of heavy soils. It promotes plant resistance to virus and pest (Landacan, 1993).

Organic fertilizers supply some amount of the nutrient requirements of the crop they promote favorable soil properties, such as granulation and good tilt for efficient aeration, easy root penetration and improve water holding capacity (PCCARD, 1982).

Koshino (1990) stated that nutrient elements form organic fertilizer are slowly released and particularly important in avoiding salt injury, ensuring a continuous supply of nutrients during the growing season and in producing product of better quality.

Compost as an organic fertilizer. Application of compost improves the physiological chemical and biological condition of the soil besides providing plant nutrients. The humus in compost serves as the colloidal material with negative electric chare and coagulated with cation and soil particles to form granules. Soil with more granules is less sticky, high buffering capacity, and has better permeability and greater

water holding capacity. It is capable of regulating plant growth and disease occurrence (Sangatnan and Sangatnan, 2000). In addition, Pataras (1984) stated that through the application of compost fertilizers is best way to prepare of soil for vegetables production that can improve the soil structure making it ideal for crop production.

Mechalak (1994) cited that compost is a good source of organic matter and nutrient for plants. It improves soil structure and water retention. Compost contains beneficial microorganisms that suppress plant pathogen in soil.

Compost application replenishes soil organic matter or humus being depleted with continuous cropping. Application of compost also activates soil microorganisms, consequently increasing the availability of nutrients that plant feed on (Marquez, 1988).

Follet (1981) added that organic residues on the soil protect the land against raindrop, splash erosion and reduce the extreme of surface temperature. When organic residues are decomposed, they supply some essential nutrient needed by plants, and makes macronutrients ready available to plant over wide range.

Crop protection in organic farming. According to Pawar (2005) controlling pest is done with no use of chemical methods. An organic farmer strategy is to prevent through good plant nutrition and management to control pest and diseases. An organic farmer relies on diverse population of soil organisms beneficial insects and birds to keep the pest in check. The use of predators, mating disruption, traps and growers will implement barriers when pest population gets out of balance. Sanitation and cultural practices and required first to growers before can resort to applying an organic pesticide to control problems on weeds insects and diseases.

Diversity in organic farming. As cited by Pawar (2005), crop diversification includes farming system as multistory cropping, mixed cropping, crop rotation and intercropping etc. that includes ecological benefits, which maintain production efficiency. As a result this practice it increases yield, reduces pest incidence, improved weed control, and reduces soil erosion, the cycling of nutrient reserves form depth of soil and transfer from nitrogen fixing species.

Importance of Varietal Evaluation in Organic Farming

Organic farming expects that the proposed standard variety is locally adapted, with resistance to pest and diseases so that high product will be obtained. However, the new revisions limit the use of non-organically produced seeds. Therefore, certified organic seed, bulbs, tubers, annual cuttings, are required to use by farmers and varieties they use should be well adapted to specific soil and fertility conditions. In several circumstances varieties that do not perform well in organic system have difference yield performance. Therefore, in selection of varieties farmers should consider the consumer requirement, supermarket requirement, variety maturity in order to achieve the best production needed (Singh 1999).

In 2006, Montes evaluated the growth and yield of potato in an organic farm at Puguis, La Trinidad, Benguet. The result revealed that genotypes 676089, 5.19.2.2. Kennebec and Ganza were highly vigorous plants at 35 DAP. Genotype 676089 produced the tallest plant had the highest weight of tubers and highest dry matter content of tubers. Genotypes IP84007.67, 676070 and 13.1.1 were resistant to late blight.

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MATERIALS AND METHODS

An area of 270 sq. m. which previously planted with potato for organic production was properly cleaned and prepared. The area was divided into three blocks consisting of ten plots each measuring 1m x 10 m. The experiment was laid out using randomized complete block design (RCBD).

The varieties used as treatment were:

VARIETY/ENTRY	SOURCE
V_1 = Landmark	BSU
V_2 = HAB 323	IPB-HRS
V_3 = BBL	BSU
V_4 = Torrent	IPB-HRS
V_5 = HAB 63	BSU
V_6 = Contender	IPB-HRS
V_7 = Green Crop	IPB-HRS
V_8 = HAB 19	BSU
V_9 = Lipstican	Kalinga

Planting and Planting Distance

Seeds were sown at a distance of 25 cm x 25 cm between hills and rows at 2-3 seeds per hill.

Cultural Management Practices

Compost at the rate of 10 kg. per $10m^2$ was applied two weeks before planting. Cultural management practices like weeding, irrigation were uniformly employed. Yellow traps were placed for leaf miner control. There was no use of synthetic fertilizers and pesticides. Marigold and corn were planted around the area to encourage crop diversity and lessen pest infestation.

Data Gathered:

1. Maturity

a. Days from sowing to emergence. This was obtained by counting the days form sowing to emergence.

b. Days from emergence to flower. This was recorded by counting the days form emergence until the plants produce flower.

c. Days from flowering to pod setting. This was obtained by counting the days from flowering until flowers become pods.

d. Days from emergence to pod setting. This was obtained by counting the days from emergence until they become pods.

e. Day form emergence to first harvesting. This was recorded by counting the days from emergence to first harvesting.

f. Day form emergence to last harvesting. This was recorded by counting the days from emergence to last harvesting.

2. Vegetative Characters

a. Plant height at 30 and 77 DAP. The height was measured from the base of the plant to the youngest shoot at 30 DAP and at harvest using foot rule from ten sample plants per entry.

b. Number of branches per plant. This was obtained by counting the branches per plant per entry.

3. Reproductive Characters

a. Number of flower clusters per plant. This was recorded by counting the flower clusters form ten sample plants per entry.

b. Number of flowers per cluster. This was recorded by counting the number of flowers per cluster from ten sample plants per entry.

c. Number of pods per cluster. The number of pods per cluster was obtained by counting the pods produced.

d. Number of pods per cluster. This was obtained by getting the number of pods per cluster.

e. Percentage pod set per cluster (%). This was obtained using following formula

$$\% \text{ pod setting} = \frac{\text{Total number of pods / cluster}}{\text{Total number of flower/cluster}} \times 100$$

f. Number of seeds per pod. The number of seeds per pod was counted from ten sample pods per entry.

g. Seed length (mm). The seed was measured using a foot rule.

h. Seed width (mm). The mid-portion of the seed was measured by using a foot rule.

4. Yield and Yield Components

a. Number and weight of marketable seeds per plot (kg). This was obtained by counting and weighing the marketable seeds per plot per entry.

b. Number and weight of non-marketable seeds per plot (kg). This was obtained by counting and weighing non-marketable seeds that were damaged, small sized and infested with pod borer.

c. Weight of 200 seed (g). This was obtained by weighing 200 seeds per plot per entry.

d. Total seed yield per plot (kg). This was obtained by getting the total number and weight of marketable and non-marketable seeds per plot.

e. Computed seed yield per hectare (kg). This was computed yield per hectare based on the yield per plot using the formula.

$$\text{Yield (tons/ha)} = \frac{\text{Total yield/plot}}{\text{Plot size } (m^2)} \times 10{,}000$$

5. Pest and Disease Incidence

a. Pod Borer (Jose, 2004)

Scale	Percent Infestation	Description
1	No infection	High resistance
2	1-25% of the total plant/plot was infected.	Mild resistance
3	25-50% of the total plant/plot was infected	Moderate Resistance

4	51-75% of the total plant/plot was infected	Susceptible
5	76-100% of the total plant/plot was infected	Very susceptible

b. Bean Rust (Jose, 2004)

Scale	Percent Infestation	Description
1	No infection	High resistance
2	1-25% of the total plant/plot was infected.	Mild resistance
3	25-50% of the total plant/plot was infected	Moderate Resistance
4	51-75% of the total plant/plot was infected	Susceptible
5	76-100% of the total plant/plot was infected	Very susceptible

6. Harvest Index. This was taken by the following formula.

$$HI = \frac{S_1DW}{RDW+S_1DW+LDW+PSDW+S_2DW}$$

Where:

S_1DW = Seeds dry weight
RDW = Root dry weight
LDW = Leaves dry weight
PSWD = Pod shell dry weight
S_2WD = Stem dry weight

7. Return on Cash Expense (ROCE). This was obtained using the following formula:

$$ROCE = \frac{\text{Net Income}}{\text{Total Cost of Production}} \times 100$$

Data Analysis

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

RESULTS AND DISCUSSION

Meteorological Data During the Conduct of the Study

Table 1 shows the temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study. Temperature ranged from 12.6 ^{o}C to 24.5 ^{o}C. The relative humidity was 78%. The rainfall was low with an average of 1.26 mm. Sunshine duration ranged from 381.9 to 521.6 kj. Temperature was favorable for snap bean production. Snap beans grow best in areas with temperature between 15 to 21 ^{o}C. Bush varieties can tolerate low temperature better than the climbing varieties (HARRDEC, 2000).

Table 1. Temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study

MONTHS	TEMPERATURE		RELATIVE HUMIDITY (%)	RAINFALL AMOUNT (mm)	SUNSHINE DURATION (kj)
	MAX	MIN			
November	23.5	15.2	80	2.5	381.4
December	24.5	15.6	70	2.5	387.0
January	23.9	13.9	77	0.03	386.6
February	23.6	12.6	77	0	521.6
MEAN	23.8	16.33	78	1.26	419.15

Soil Chemical Properties

Table 2 shows the pH, OM, N, P, and K before planting. The soil pH was 6.72, soil content such as organic matter (2.5 %), phosphorous (90 ppm), potassium (312 ppm) and for nitrogen (0.125 %) maybe favorable for snap bean production. Snap bean can tolerate soil pH 5.5 to 6.5 but perform best between a pH range of 5.8 to 6.0 (HARRDEC, 2000).

Table 2. Soil chemical properties of the experimental area before planting

Before planting	Soil chemical properties/content
PH	6.72
OM(%)	2.5
N (%)	0.125
P (ppm)	90
K (ppm)	312

Days from Sowing to Emergence

Statistical analysis revealed highly significant differences on the number of days from sowing to emergence among the nine varieties evaluated (Table 3). Landmark, HAB 323, Torrent, HAB 63, Green Crop and HAB 19 were the earliest to emerge within seven days. BBL, Contender and "Lipstican" were the latest to emerge.

The ability of the varieties to germinate could be attributed to their varietal characteristics.

Days from Emergence to Flowering

Contender and ":Lipstican" showed highly significant differences from emergence to flowering as compared to Torrent, Landmark and BBL which were the latest to produce flower (34 days). Other varieties produced flowers within 33 days from emergence. The flowering differences could be attributed to their genetic make-up.

Days from Emergence to First and Last Harvesting

Highly significant differences were noted on the number of days from emergence to first harvesting (Table 3). Contender was the earliest to be harvested at 73 days while BBL was the latest to be harvested at 83 days from emergence. Contender was the first to be harvested in 76 days. BBL was the latest to be harvested at 89 days from emergence.

Days from Emergence to Pod Setting

Table 4 shows the number of days from emergence to pod setting. Highly significant differences were observed on the number of days from emergence to pod setting. Contender and "Lipstican" were the earliest to produce pods at 35 days from emergence. The latest to produce pods was the BBL (38 days). Other varieties produced pods at 37 days from emergence.

Table 3. Number of days from sowing to emergence, from emergence to flowering, and to first harvesting and last harvesting of nine bush snap bean varieties

VARIETY	NUMBER OF DAYS FROM			
	SOWING TO EMERGENCE	EMERGENCE TO FLOWERING	EMERGENCE TO FIRST HARVESTING	EMERGENCE TO LAST HARVESTING
Landmark	7[a]	34[c]	77[b]	84[b]
HAB 323	7[a]	33[b]	77[b]	84[b]
BBL	8[b]	34[c]	83[c]	89[c]
Torrent	7[a]	34[c]	77[b]	84[b]
HAB 63	7[a]	33[b]	74[ab]	77[ab]
Contender	8[b]	31[a]	73[a]	76[a]
Green Crop	7[a]	33[b]	77[b]	84[b]
HAB 19	7[a]	33[b]	74[ab]	77[ab]
Lipstican	8[b]	31[a]	77[b]	84[b]
CV(%)	0	0.93	0	1.17

Means with the same letter are not significantly different by DMRT (P>0.05)

Days From Flowering to Pod Setting

Table 4 shows highly significant differences on the number of days from flowering to pod setting. Landmark and Torrent were the earliest to produce pods. On the other hand, HAB 323, HAB 63, HAB 19, "Lipstican" Green Crop and Contender produce pods later at 4 days from flowering

Table 4. Number of days from emergence to pod setting, and flowering to pod setting of nine bush snap bean varieties

VARIETY	NUMBER OF DAYS FROM:	
	EMERGENCE TO POD SETTING	FLOWERING TO POD SETTING
Landmark	37[b]	3[a]
HAB 323	37[b]	4[b]
BBL	38[c]	4[b]
Torrent	37[b]	3[a]
HAB 63	37[b]	4[b]
Contender	35[a]	4[b]
Green Crop	37[b]	4[b]
HAB 19	37[b]	4[b]
Lipstican	35[a]	4[b]
CV (%)	0.83	0

Means with the same letter are not significantly different by DMRT (P>0.05)

Height at 30 and at 77 DAP

Table 5 shows the height at the plants at 30 and 77 DAP. HAB 323 significantly produced the tallest plants but comparable with "Lipstican", HAB 19, HAB 63 and Torrent. Variety Landmark produce the shortest plants. At 77 DAP, all varieties had increased in height. Green Crop and Torrent significantly produced the tallest plants. The shortest plants were obtained from HAB 323 but was comparable with Landmark, HAB 63, Contender, HAB 19 and "Lipstican."

Number of Branches Per Plant

The most branches per plant were obtained from HAB 323, Contender, Green Crop and HAB 19 with three branches which is comparable with those obtained from BBL, Land mark, HAB 63. "Lipstican" and Torrent produced two and one branch per plant, respectively (Table 5).

Numbers of Flower Clusters per Plant

No significant differences among the nine varieties were noted on the number of flower clusters per plant (Table 6). Flower cluster per plant ranged from 3-4.

Table 5. Height at 30 and 77 DAP and number of branches per plant of nine bush snap bean varieties

VARIETY	HEIGHT		NUMBER OF BRANCHES PER PLANT
	30 DAP (cm)	77 DAP (cm)	
Landmark	9.25^{d}	20.88^{cb}	2^{ab}
HAB 323	12.99^{a}	20.37^{c}	3^{a}
BBL	11.08^{c}	23.50^{b}	2^{ab}
Torrent	12.57^{ab}	27.29^{a}	1^{b}
HAB 63	12.72^{ab}	22.07^{cb}	2^{ab}
Contender	11.53^{bc}	21.65^{cb}	3^{a}
Green Crop	11.97^{abc}	27.64^{a}	3^{a}
HAB 19	12.79^{ab}	21.14^{cb}	3^{a}
Lipstican	12.72^{ab}	21.47^{cb}	2^{ab}
CV (%)	5.54	6.96	24.22

Means with the same letter are not significantly different by DMRT (P>0.05)

Number of Flowers Per Cluster

No significant differences were noted on the number of flowers per cluster. The varieties evaluated produced 3 to 4 flowers per cluster (Table 6).

Number of Pod Clusters Per Plant

No significant differences were observed on the number of pod clusters per plant (Table 7). Pod cluster ranged from 3-4 per plant.

Table 6. Number of flower clusters and flowers per clusters per plant of nine bush snap bean varieties

VARIETY	NUMBER	
	FLOWER CLUSTER	FLOWER PER CLUSTER
Landmark	4	3
HAB 323	3	4
BBL	4	3
Torrent	4	3
HAB 63	3	3
Contender	3	3
Green Crop	3	3
HAB 19	3	3
Lipstican	4	3
CV %	13.40	12.08

Number of Pods Per Cluster

No significant difference was noted on the number of pods per cluster among the nine varieties evaluated (Table 7). Pods per cluster ranged from 2-3 per plant.

Percentage Pod Set

HAB 63 had the highest pod set of 89.6%. Green Crop had the lowest percentage pod set of 70.31% (Table 7). However, the differences among varieties were not significant.

Table 7. Number of pod cluster, pods per cluster per plant and percentage pod set of nine bush snap bean varieties

VARIETY	NUMBER		PERCENTAGE POD SET
	POD CLUSTER/PLANT	PODS PER CLUSTER	
Landmark	3	3	83.51[ab]
HAB 323	4	3	86.70[ab]
BBL	3	2	77.80[ab]
Torrent	3	3	86.22[ab]
HAB 63	3	3	89.61[a]
Contender	3	3	77.57[ab]
Green Crop	3	2	70.31[b]
HAB 19	3	3	81.60[ab]
Lipstican	3	2	78.94[ab]
CV %	14.76	18.22	10.72

Means with the same letter are not significantly different by DMRT (P>0.05

Number of Seeds Per Pod

HAB 323 and HAB 19 significantly produced the most seeds per pod. "Lipstican" had the least seeds per pod (Table 8). The significant differences could be attributed to their varietal characteristics. More seeds were noted from the small seeded varieties (HAB 323 and HAB 19) as compared with the larger seeds obtained from "Lipstican."

Seed Length

Highly significant differences were observed on seed length (Table 8). Contender and "Lipstican" had significantly obtained the longest seeds. The shortest seeds were obtained from HAB 63 but comparable with Landmark, HAB 323 and HAB 19.

Seed Width

"Lipstican" had significantly obtained the widest seeds followed by Green Crop but was comparable with Contender. The narrowest seeds were obtained from HAB 63 (Table 8).

Table 8. Number of seeds per pod, seed length and seed width of nine bush snap bean varieties

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VARIETY	NUMBER OF SEEDS PER POD	SEED	
		LENGTH (mm)	WIDTH (mm)
Landmark	5[b]	12.57[cd]	5.30[c]
HAB 323	6[a]	12.43[cd]	4.97[c]
BBL	5[b]	14.33[b]	5.30[c]
Torrent	5[b]	13.23[c]	5.63[c]
HAB 63	5[b]	12.10[d]	5.07[c]
Contender	5[b]	17.00[a]	6.53[b]
Green Crop	5[b]	15.07[b]	6.67[b]
HAB 19	6[a]	12.47[cd]	5.43[c]
Lipstican	4[c]	16.93[a]	7.20[a]
CV %	7.65	3.68	6.24

Means with the same letter are not significantly different by DMRT (P>0.05)

Number and Weight of Marketable Seeds

Highly significant differences among the varieties were noted for numbers of marketable seeds (Table 9). HAB 323, HAB 19, and HAB 63 produced the most seeds per 10 m^2. The lowest number of marketable seeds was obtained from "Lipstican". For seed weight, significant differences were observed among the varieties tested. "Lipstican" significantly produced the heaviest marketable seeds but comparable with HAB 19. The lowest weight of marketable seeds was obtained from Torrent.

Number and Weight of Non-Marketable Seeds

Landmark, HAB 323, HAB63 had significantly produced the most non-marketable seeds but comparable with BBL, Torrent and Contender, "Lipstican" produced the lowest number of non-marketable, which maybe due to moderate resistance to pod borer. As to the weight of non- marketable seeds, Landmark, HAB 323 and HAB 63 produced the highest weight. "Lipstican" produced the lowest weight of non-marketable seeds.

Table 9. Number and weight of marketable and non-marketable seeds of nine bush snap bean varieties

VARIETY	MARKETABLE		NON-MARKETABLE	
	NUMBER	WEIGHT ($kg/10m^2$)	NUMBER	WEIGHT ($kg/10m^2$)
Landmark	1825^{b}	0.50^{d}	443^{c}	0.090^{c}
HAB 323	3187^{a}	0.73^{b}	438^{c}	0.070^{abc}
BBL	1802^{b}	0.55^{dc}	290^{ab}	0.057^{b}
Torrent	1549^{b}	0.50^{d}	346^{ab}	0.050^{a}
HAB 63	2869^{a}	0.71^{b}	441^{c}	0.067^{abc}
Contender	1564^{b}	0.69^{c}	347^{ab}	0.087^{ab}
Green Crop	1628^{b}	0.73^{b}	217^{b}	0.057^{b}
HAB 19	2973^{a}	0.83^{ab}	268^{abc}	0.047^{a}
Lipstican	1535^{b}	0.919^{a}	122^{a}	0.047^{a}
CV %	12.77	12.61	27.42	27.42

Means with the same letter are not significantly different by DMRT (P>0.05)

Weight of 200 Seeds

Highly significant results were obtained on the weight of 200 seeds per 10 m^2 (Table 10). "Lipstican" had significantly produced the highest weight while HAB 63 produced the lowest weight of 200 seeds with a mean of 45g per 10 m^2.

The heavy seeds of 'Lipstican" could be attributed to long and wide seeds.

Total Seed Yield

The heaviest seed yield per plot was produced by "Lipstican" (Table 10). Comparable seed yield was harvested from HAB 19. However, slight difference in yield of Green Crop, Contender, HAB 63, and HAB 323 was obtained. All the aforementioned varieties significantly outyielded Landmark, BBL and Torrent.

The high seed yield of "Lipstican", Contender, HAB 63 and HAB 323 could be due to long and wide seeds produced. Fig. 1 shows the harvested seeds from the nine varieties evaluated under organic production.

Computed Seed Yield

Table 10 presents the computed seed yield per hectare of different bush snap bean varieties studied. "Lipstican" significantly outyielded all the varieties evaluated but has comparable yield with HAB 19. The results show that "Lipstican" is the best yielder under organic production at La Trinidad, Benguet.

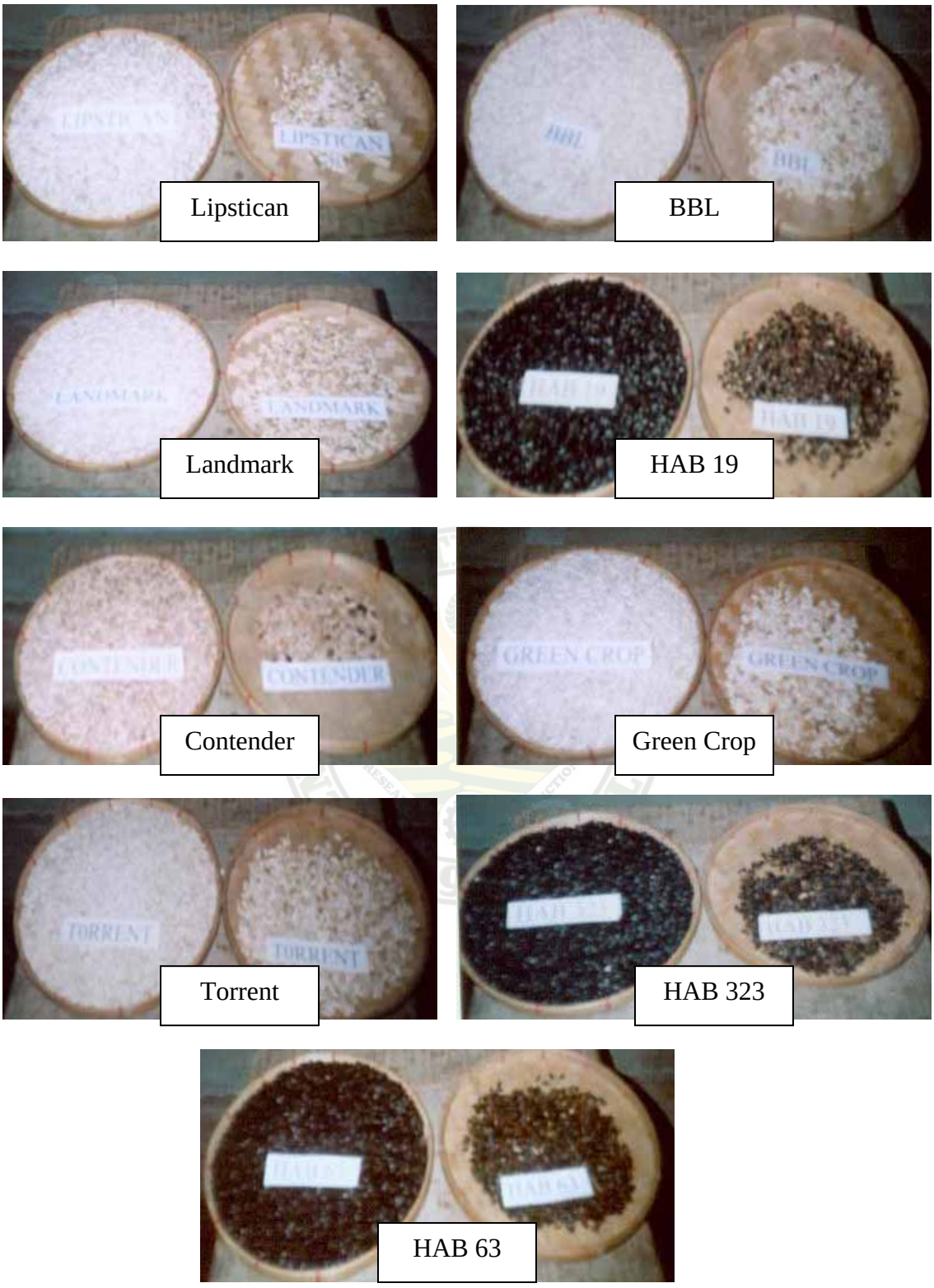

Fig. 1. Seeds from the nine bush snap bean varieties

Table 10. Weight of 200 seeds, total seed yield per plot and computed yield per hectare of nine bush snap bean varieties

VARIETY	WEIGHT OF 200 SEEDS (g)	SEED YIELD	
		Kg/10m^2	Kg/Ha
Landmark	50.00^{ef}	0.60^{c}	596.67^{c}
HAB 323	46.67^{fg}	0.80^{b}	803.33^{b}
BBL	56.67^{d}	0.60^{c}	603.33^{c}
Torrent	60.00^{d}	0.55^{c}	550.00^{c}
HAB 63	45.00^{g}b	0.75^{b}	753.33^{b}
Contender	86.67^{b}	0.78^{b}	780.00^{b}
Green Crop	81.67^{c}	0.78^{b}	783.33^{b}
HAB 19	51.67^{e}	0.88^{ab}	880.67^{ab}
Lipstican	113.67^{a}	0.96^{a}	960.00^{a}
CV %	4.17	11.15	11.15

Means with the same letter are not significantly different by DMRT (P>0.05)

Bean Rust and Pod Borer Occurrence

Visual rating for occurrence of bean rust and pod borer among the nine varieties was done during the reproductive stage. It was observed that all the varieties evaluated were susceptible to bean rust. For pod borer, “Lipstican” and Green Crop showed mild resistance. BBL, Torrent and Contender were moderately resistant while Landmark, HAB 323 and HAB 63 were susceptible to pod borer infestation.

Table 11. Pod borer occurrence of nine bush snap bean varieties

VARIETY	POD BORER RATING
Landmark	Susceptible
HAB 323	Susceptible
BBL	Moderate Resistant
Torrent	Moderate Resistant
HAB 63	Susceptible
Contender	Moderate Resistant
Green Crop	Mild Resistance
HAB 19	Moderate Resistant
Lipstican	Mild Resistance

Harvest Index

Table 12 shows the harvest index of the nine varieties evaluated. Numerically, HAB 323 had the highest harvest index followed by Contender and "Lipstican". The lowest harvest index was obtained from BBL. However, no significant difference among varieties was noted.

Table 12. Harvest index of nine bush snap bean varieties

VARIETY	HARVEST INDEX
Landmark	0.24
HAB 323	0.24
BBL	0.23
Torrent	0.26
HAB 63	0.29
Contender	0.24
Green Crop	0.27
HAB 19	0.25
Lipstican	0.27
CV%	14.81

Means with the same letter are not significantly different by DMRT (P>0.05)

Return on Cash Expenses (ROCE)

Positive ROCE was obtained from the eight varieties tested. HAB 19 had the highest ROCE with 74.93 % followed by HAB 323 (55.18 %), "Lipstican" (54.06 %) and Green Crop (53.78 %). Landmark which produced low marketable yield had a negative ROCE. BBL obtained the lowest ROCE with 0.64 %.

Table 13. Cost and return analysis of nine bush snap bean varieties (270 m^2)

VARIETY	TOTAL COSTOF PRODUCTION (Php)	SEED YIELD (kg)	GROSS INCOME (Php)	NET INCOME (Php)	ROCE %
Landmark	423.67	1.51	392.60	-31.07	-7.33
HAB 323	453.67	2.20	704.00	250.33	55.18
BBL	423.67	1.64	426.40	2.73	0.64
Torrent	453.67	1.50	480.00	26.33	5.80
HAB 63	423.67	2.12	551.20	127.53	30.10
Contender	453.67	2.08	665.60	211.93	46.71
Green Crop	453.67	2.18	697.60	243.97	53.78
HAB 19	453.67	2.48	793.60	339.93	74.93
Lipstican	418.67	2.74	685.00	266.33	54.06

- Total expenses include land preparation, seeds, compost, maintenance which includes weeding, irrigation, and hilling – up.
- Selling price: HAB 323, Torrent, Contender, Green Crop and HAB = Php 320.00/kg
  Land mark, BBL, HAB 63 = 260.00/kg
  Lipstican = Php 250.00/kg

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

The study was conducted at Balili, La Trinidad, Benguet to determine; the agronomic characters of different bush snap bean varieties grown organically, the best performing variety of bush snap bean in terms of growth, yield and resistance of pest and diseases and the economic benefit of planting different bush snap bean varieties under organic production.

The results revealed that Landmark, HAB 323, Torrent, HAB 63 Green Crop and HAB 19 were the earliest to emerge and produce pods. “Lipstican” and Contender were the earliest to produce flower and to be harvested. HAB 323 produced the tallest plants at 30 DAP. However, Green Crop was the tallest at 77 DAP. There no significant differences among varieties on the number of flower clusters, flowers per cluster, pod clusters, pods per cluster and percentage pod set.

Among the varieties, “Lipstican” had the heaviest weight of 200 seeds, marketable seeds, total seed yield per 10 m^2 and per hectare. Contender showed comparable result with “Lipstican” producing high marketable seed yield. As for resistance to pod borer, Green Crop and “Lipstican” were rated mild resistance.

Positive ROCE was obtained for the eight varieties. Only Landmark obtained a negative ROI. The highest ROCE were obtained from HAB 19, HAB 323, “Lipstican” and Green Crop.

Conclusions

"Lipstican" and HAB 19 consistently showed good agronomic performance under organic production. These varieties are early maturing, high yielding and resistant pod borer under La Trinidad condition.

Recommendation

Based on the conditions of the study, "Lipstican" and HAB 19 could be recommended for organic production under La Trinidad, Benguet.

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APPENDICES

APPENDIX TABLE 1. Number of days from sowing to emergence of nine snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	7	7	7	21	7[b]
HAB 323	7	7	7	21	7[b]
BBL	8	8	8	24	8[a]
Torrent	7	7	7	21	7[b]
HAB 63	7	7	7	21	7[b]
Contender	8	8	8	24	8[a]
Green Crop	7	7	7	21	7[b]
HAB 19	7	7	7	21	7[b]
Lipstican	8	8	8	24	8[a]
TOTAL	66	66	66	198	66

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.00	0.00			
Treatment	8	6.00	0.75	99999.99**	2.59	3.89
Error	16	0.00	0.00			
TOTAL	26	6.000				

** - Highly Significant Coefficient of Variance = 0%

APPENDIX TABLE 2. Number of days from emergence to flowering of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	34	34	34	102	34[c]
HAB 323	32	33	33	98	33[b]
BBL	33	34	34	101	34[c]
Torrent	34	34	34	102	34[c]
HAB 63	33	33	33	99	33[b]
Contender	31	31	32	94	31[a]
Green Crop	33	33	33	99	33[b]
HAB 19	33	33	33	99	33[b]
Lipstican	31	31	31	93	31[a]
TOTAL	294	296	297	887	296

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.52	0.26			
Treatment	8	27.41	0.43	37.00**	2.59	3.89
Error	16	1.48	0.09			
TOTAL	26	29.41				

** - Highly Significant Coefficient of Variance = 0.93%

APPENDIX TABLE 3. Number of days from flowering to pod setting of nine snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	3	3	3	9	3[a]
HAB 323	4	4	4	12	4[b]
BBL	4	4	4	12	4[b]
Torrent	3	3	3	9	3[a]
HAB 63	4	4	4	12	4[b]
Contender	4	4	4	12	4[b]
Green Crop	4	4	4	12	4[b]
HAB 19	4	4	4	12	4[b]
Lipstican	4	4	4	12	4[b]
TOTAL	34	34	34	105	34

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.00	0.00			
Treatment	8	4.67	0.58	99999.99**	2.59	3.89
Error	16	0.00	0.00			
TOTAL	26	4.07				

** - Highly Significant Coefficient of Variance = 0.%

APPENDIX TABLE 4. Number of days from emergence to pod setting of nine snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	37	37	37	111	37[b]
HAB 323	36	37	37	110	37[b]
BBL	37	38	38	113	38[c]
Torrent	37	37	37	111	37[b]
HAB 63	37	37	37	111	37[b]
Contender	37	35	36	106	35[a]
Green Crop	35	37	37	111	37[b]
HAB 19	37	37	37	111	37[b]
Lipstican	37	35	35	105	35[a]
TOTAL	328	330	331	989	330

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.52	0.26			
Treatment	8	18.30	2.29	24.70**	2.59	3.89
Error	16	1.48	0.09			
TOTAL	26	20.30				

** - Highly Significant Coefficient of Variance = 0.83%

APPENDIX TABLE 5. Number of days from emergence to first harvesting of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	77	77	77	231	77[c]
HAB 323	77	77	77	231	77[c]
BBL	83	83	83	249	83[d]
Torrent	77	77	77	231	77[c]
HAB 63	74	74	74	222	74[b]
Contender	73	73	73	219	73[a]
Green Crop	77	77	77	231	77[c]
HAB 19	74	74	74	222	74[b]
Lipstican	77	77	77	231	77[c]
TOTAL	695	695	695	2,085	695

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.0	0.00			
Treatment	8	6.00	0.75	99999.99**	2.59	3.89
Error	16	0.00	0.00			
TOTAL	26	6.00				

** - Highly Significant

Coefficient of Variance = 0%

APPENDIX TABLE 6. Number of days from emergence to last harvesting of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	84	84	84	252	84[c]
HAB 323	84	84	84	2252	84[c]
BBL	89	89	89	267	89[d]
Torrent	84	84	84	252	84[c]
HAB 63	77	77	77	231	77[b]
Contender	76	76	76	228	76[a]
Green Crop	84	84	84	252	84[c]
HAB 19	77	77	77	231	77[b]
Lipstican	84	84	84	252	84[c]
TOTAL	739	739	739	2,217	739

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.85	0.93			
Treatment	8	531.41	66.43	71.74**	2.59	3.89
Error	16	14.82	0.93			
TOTAL	26	548.07				

** - Highly Significant

Coefficient of Variance = 1.17%

APPENDIX TABLE 7. Plant height at 30 DAP (cm) of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	9.34	8.93	9.48	27.75	9.25[d]
HAB 323	13.28	12.99	12.69	38.96	12.99[a]
BBL	10.82	11.27	11.14	33.23	11.08[c]
Torrent	12.93	11.84	12.93	37.70	12.57[bc]
HAB 63	12.97	12.59	12.59	38.15	12.72[ab]
Contender	11.88	12.45	10.27	34.60	11.53[bc]
Green Crop	12.83	10.56	12.53	35.92	11.97[abc]
HAB 19	13.33	12.75	12.28	38.36	12.79[ab]
Lipstican	13.67	12.53	11.97	38.17	12.72[ab]
TOTAL	110.55	105.91	105.88	317	107

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.85	0.93			
Treatment	8	531.41	66.43	71.74**	2.59	3.89
Error	16	14.81	0.93			
TOTAL	26	548.07				

** - Highly Significant Coefficient of Variance = 1.17%

APPENDIX TABLE 8. Plant height at 77 DAP (cm) of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	21.41	21.17	19.96	62.64	20.88^{bc}
HAB 323	22.37	18.24	20.51	61.12	20.37^{c}
BBL	24.17	25.14	21.20	70.51	23.50^{b}
Torrent	25.39	26.73	29.74	81.86	27.29^{a}
HAB 63	23.23	21.75	21.22	66.20	22.06^{bc}
Contender	23.67	21.33	19.94	64.94	21.65^{bc}
Green Crop	28.99	25.82	28.12	82.93	27.64^{a}
HAB 19	24.11	20.76	21.56	66.43	22.14^{bc}
Lipstican	23.93	20.72	19.75	64.40	21.46^{bc}
TOTAL	217.27	201.76	202	621.03	394.80

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	17.55	8.77			
Treatment	8	172.11	21.51	8.40**	2.59	3.89
Error	16	40.98	2.56			
TOTAL	26	230.639				

** - Highly Significant Coefficient of Variance = 6.96%

APPENDIX TABLE 9. Number of branches per plant of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	2	2	2	6	2
HAB 323	4	3	2	9	3
BBL	2	2	2	6	2
Torrent	2	1	1	4	1
HAB 63	2	2	2	6	2
Contender	3	3	3	9	3
Green Crop	3	2	3	8	3
HAB 19	3	3	2	8	3
Lipstican	3	2	1	6	2
TOTAL	24	20	18	62	21

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.56	0.78			
Treatment	8	7.33	0.92	2.87**	2.59	3.89
Error	16	5.11	0.32			
TOTAL	26	14.00				

** - Highly Significant Coefficient of Variance = 24.22%

APPENDIX TABLE 10. Number of flower cluster per plant of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	3	4	4	11	4
HAB 323	3	4	3	10	3
BBL	4	4	4	12	4
Torrent	3	4	4	11	4
HAB 63	4	3	3	10	3
Contender	3	4	3	10	3
Green Crop	3	4	3	10	3
HAB 19	3	3	3	9	3
Lipstican	4	4	3	11	4
TOTAL	30	34	30	94	31

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.19	0.59			
Variety	8	2.07	0.26	1.19^{ns}	2.59	3.89
Error	16	3.48	0.22			
TOTAL	26	6.74				

^{ns} - Not Significant Coefficient of Variance = 13.40 %

APPENDIX TABLE 11. Number of flower cluster per plant of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	4	3	3	10	3
HAB 323	4	4	3	11	4
BBL	3	3	3	9	3
Torrent	3	3	3	9	3
HAB 63	3	3	3	9	3
Contender	3	3	3	9	3
Green Crop	3	3	4	11	3
HAB 19	4	3	3	10	3
Lipstican	3	3	3	9	3
TOTAL	30	28	28	86	28

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05 %	0.01
Block	2	0.30	0.14			
Variety	8	1.41	0.18	1.19^{ns}	2.59	3.89
Error	16	2.37	0.15			
TOTAL	26	4.07				

^{ns} - Not Significant Coefficient of Variance = 12.08 %

APPENDIX TABLE 12. Number of Pod per cluster plant of nine bush snap varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	3	3	2	8	3
HAB 323	4	3	3	10	3
BBL	2	2	2	6	2
Torrent	3	2	3	8	3
HAB 63	3	3	3	9	3
Contender	3	3	3	9	3
Green Crop	3	2	2	7	2
HAB 19	2	3	3	8	3
Lipstican	2	3	2	7	2
TOTAL	25	24	23	72	24

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
BLOCK	2	0.22	0.11			
Variety	8	4.00	0.50	2.12^{ns}	2.59	3.89
Error	16	3.78	0.24			
TOTAL	26	8.00				

^{ns} - Not Significant Coefficient of Variance = 18.22

APPENDIX TABLE 13. Number of pod cluster per plant of nine bush snap varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	3	3	3	9	3
HAB 323	3	4	3	10	3
BBL	4	4	3	11	4
Torrent	3	3	4	10	3
HAB 63	4	3	3	10	3
Contender	3	3	3	9	3
Green Crop	3	4	3	10	3
HAB 19	4	3	3	10	3
Lipstican	3	3	3	9	3
TOTAL	30	30	28	88	28

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.30	0.15			
Variety	8	1.19	0.15	0.64^{ns}	2.59	3.89
Error	16	3.70	0.23			
TOTAL	26	5.19				

^{ns} - Not Significant Coefficient of Variance = 14.76 %

APPENDIX TABLE 14. Number of seeds per pod of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	6	5	5	16	5[b]
HAB 323	6	6	6	18	6[a]
BBL	5	5	5	15	5[b]
Torrent	5	5	5	15	5[b]
HAB 63	5	6	5	16	5[b]
Contender	5	5	4	14	5[b]
Green Crop	5	5	5	15	5[b]
HAB 19	5	6	6	17	6[a]
Lipstican	4	4	4	12	4[b]
TOTAL	46	47	45	138	46

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.22	0.11			
Variety	8	8.00	1.00	6.55**	2.59	3.89
Error	16	2.44	0.15			
TOTAL	26	10.67				

** - highly Significant Coefficient of Variance = 7.65%

APPENDIX TABLE 15. Weight of 200 seeds of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	50	55	45	150	50.00^{ef}
HAB 323	50	45	45	140	46.67^{fg}
BBL	60	55	55	170	56.67^{d}
Torrent	60	60	60	180	60.00^{d}
HAB 63	45	45	45	135	45.00^{g}
Contender	90	90	80	260	86.67^{b}
Green Crop	85	80	80	245	81.67^{c}
HAB 19	50	55	50	155	51.67^{e}
Lipstican	115	115	110	340	113.33^{a}
TOTAL	605	600	570	1775	591.68

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	79.63	39.82			
Variety	8	12935.19	1616.90	214.92**	2.59	3.89
Error	16	120.37	7.52			
TOTAL	26	13135.19				

** - Highly Significant Coefficient of Variance = 4.17%

APPENDIX TABLE 16. Seed length of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	12.80	12.70	12.20	37.70	12.57[cd]
HAB 323	12.50	13.00	11.80	37.30	12.43[cd]
BBL	14.70	13.90	14.40	43.00	14.33[b]
Torrent	13.00	13.70	13.00	39.70	13.23[c]
HAB 63	12.60	11.80	11.90	36.30	12.10[d]
Contender	17.10	16.80	17.00	50.90	17.00[a]
Green Crop	16.10	14.30	14.80	45.20	15.07[b]
HAB 19	11.80	12.80	12.80	37.40	12.47[cd]
Lipstican	16.90	17.40	16.50	50.80	16.93[a]
TOTAL	127.50	126.40	124.40	378.30	126.13

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.55	0.27			
Variety	8	89.13	11.14	41.80	2.59	3.89
Error	16	4.26	0.27			
TOTAL	26	93.95				

** - Highly Significant Coefficient of Variance = 3.68 %

APPENDIX TABLE 17. Seed width of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	5.40	5.20	5.30	15.90	5.30[c]
HAB 323	4.90	5.20	5.80	15.90	5.30[c]
BBL	5.20	5.20	5.50	15.90	5.30[c]
Torrent	5.80	5.60	5.50	16.90	5.63[c]
HAB 63	5.10	5.00	5.10	15.20	5.07[c]
Contender	6.70	6.80	6.10	19.60	6.53[b]
Green Crop	7.60	6.30	6.10	20.00	6.67[ab]
HAB 19	5.60	5.40	5.30	16.30	5.43[c]
Lipstican	7.10	7.40	7.10	21.60	7.20[a]
TOTAL	53.40	52.10	54.8	160.3	52.43

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.16	0.08			
Variety	8	14.08	1.76	13.33**	2.59	3.89
Error	16	2.11	0.13			
TOTAL	26	16.35				

** - highly Significant Coefficient of Variance = 6.24%

APPENDIX TABLE 18. Percentage pod set of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	77.78	90.00	82.76	250.54	83.51
HAB 323	90..00	85.71	84.38	260.09	86.70
BBL	77.42	76.67	79.31	233.40	77.80
Torrent	82.35	82.76	93.55	258.70	86.22
HAB 63	96.88	84.85	87.10	268.83	89.61
Contender	78.79	78.13	75.76	232.70	77.57
Green Crop	86.21	64.71	60.00	210.92	70.31
HAB 19	66.67	93.33	84.85	244.85	81.60
Lipstican	79.19	89.29	73.33	236.81	78.99
TOTAL	735.29	745.45	641.73	2196.84	732.26

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	33.41	16.71			
Variety	8	823.23	102.90	1.47^{ns}	2.59	3.89
Error	16	1122.51	70.15			
TOTAL	26	1979.15				

^{ns} - not Significant Coefficient of Variance = 10.27%

APPENDIX TABLE 19. Number of marketable seed per $10m^2$ of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	1805	1860	1810	5475	1825
HAB 323	3433	3304	2824	9561	3187
BBL	1736	1760	1911	5407	1802
Torrent	881	2053	1712	4646	1549
HAB 63	2882	2888	2832	8602	2867
Contender	1644	1626	1423	4693	1564
Green Crop	1860	1405	1618	4883	1628
HAB 19	3056	3223	2659	8918	2973
Lipstican	1548	1514	1544	4606	1535
TOTAL	18845	19689	19765	58299	19433

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	92235.85	46117.93			
Variety	8	11486697.63	1435837.20	19.89**	2.59	3.89
Error	16	1155140.82	72196.30			
TOTAL	26	12734074.30				

** - highly Significant Coefficient of Variance = 12.77%

APPENDIX TABLE 20. Weight of marketable seed per plot $10m^2$ of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	0.55	0.50	0.46	1.51	0.50^{d}
HAB 323	0.79	0.77	0.64	2.20	0.73^{b}
BBL	0.53	0.58	0.53	1.64	0.55^{cd}
Torrent	0.33	0.65	0.52	1.50	0.50^{d}
HAB 63	0.69	0.73	0.70	2.12	0.71^{b}
Contender	0.76	0.72	0.60	2.08	0.69^{bc}
Green Crop	0.87	0.61	0.70	2.18	0.73^{b}
HAB 19	0.86	0.91	0.71	2.48	0.83^{ab}
Lipstican	0.95	0.89	0.90	2.74	0.91^{a}
TOTAL	6.33	6.29	5.75	18.51	6.15

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.03	0.01			
Variety	8	0.49	0.06	8.24**	2.59	3.89
Error	16	0.12	0.01			
TOTAL	26	0.63				

** - highly Significant Coefficient of Variance = 12.6 %

APPENDIX TABLE 21. Number of non-marketable seeds per 10 m^2 of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	348	478	502	1328	443[a]
HAB 323	510	377	428	1315	438[a]
BBL	297	354	218	869	290[ab]
Torrent	401	141	496	1038	346[ab]
HAB 63	504	436	384	1324	441[a]
Contender	501	332	289	1122	374[ab]
Green Crop	278	204	170	652	217[bc]
HAB 19	304	310	191	805	268[abc]
Lipstican	163	124	78	365	122[c]
TOTAL	3306	2747	2756	8809	2936

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	22407.41	11203.70			
Variety	8	301315.85	37664.48	4.70**	2.59	3.89
Error	16	128275.26	8017.20			
TOTAL	26	451998.52				

** - highly Significant Coefficient of Variance = 21.42%

APPENDIX TABLE 22. Weight of non-marketable seed per plot $10m^2$ (kg) of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	0.08	0.11	0.09	0.28	0.093[a]
HAB 323	0.08	0.06	0.07	0.21	0.070[abc]
BBL	0.06	0.07	0.04	0.17	0.057[bc]
Torrent	0.10	0.03	0.02	0.15	0.050[c]
HAB 63	0.08	0.07	0.05	0.20	0.067[abc]
Contender	0.12	0.08	0.06	0.26	0.087[ab]
Green Crop	0.08	0.05	0.04	0.17	0.057[bc]
HAB 19	0.06	0.04	0.04	0.14	0.047[c]
Lipstican	0.08	0.03	0.03	0.14	0.047[c]
TOTAL	0.74	0.54	0.44	1.72	0.573

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.01	0.00			
Variety	8	0.01	0.00	2.85*	2.59	3.89
Error	16	0.01	0.00			
TOTAL	26	0.02				

** - highly Significant Coefficient of Variance = 27.421%

APPENDIX TABLE 23. Total seed yield per $10m^2$ (kg) of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	0.63	0.61	0.55	1.79	0.60[c]
HAB 323	0.87	0.83	0.71	2.41	0.80[b]
BBL	0.59	0.65	0.57	1.81	0.60[c]
Torrent	0.43	0.68	0.54	1.65	0.55[c]
HAB 63	0.77	0.74	0.75	2.26	0.75[b]
Contender	0.88	0.80	0.66	2.34	0.78[b]
Green Crop	0.95	0.66	0.74	2.35	0.78[b]
HAB 19	0.92	0.97	0.75	2.64	0.88[ab]
Lipstican	1.03	0.92	0.93	2.88	0.96[a]
TOTAL	7.07	6.86	6.20	20.13	6.70

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.05	0.02			
Variety	8	0.45	0.06	8.18**	2.59	3.89
Error	16	0.11	0.01			
TOTAL	26	0.60				

** - highly Significant Coefficient of Variance = 11.15%

APPENDIX TABLE 24. Computed seed yield per hectare (kg) of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	630	610	550	1790	596.67[c]
HAB 323	870	830	710	2410	803.33[b]
BBL	590	650	570	1810	603.33[c]
Torrent	430	680	540	1650	550.00[c]
HAB 63	770	740	750	2260	753.33[b]
Contender	880	800	660	2340	780.00[b]
Green Crop	950	660	740	2350	783.33[b]
HAB 19	920	970	750	2640	880.67[ab]
Lipstican	1030	920	930	2880	960.00[a]
TOTAL	7070	6860	6200	20130	6710.66

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	45800.00	22900.00			
Variety	8	452133.33	56516.67	8.18**	2.59	3.89
Error	16	110533.33	6908.33			
TOTAL	26	608466.67				

** - highly Significant Coefficient of Variance = 11.15%

APPENDIX TABLE 25. Harvest index of nine bush snap bean varieties

VARIETY	BLOCK			TOTAL	MEAN
	I	II	III		
Landmark	0.27	0.23	0.21	0.71	0.24
HAB 323	0.26	0.20	0.25	0.71	0.24
BBL	0.21	0.23	0.24	0.68	0.23
Torrent	0.23	0.32	0.24	0.79	0.26
HAB 63	0.33	0.26	0.28	0.87	0.29
Contender	0.26	0.19	0.27	0.72	0.24
Green Crop	0.31	0.29	0.20	0.80	0.27
HAB 19	0.21	0.25	0.26	0.75	0.25
Lipstican	0.27	0.30	0.24	0.81	0.27
TOTAL	2.35	2.27	2.19	6.81	2.29

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.00	0.00			
Variety	8	0.01	0.00	.89^{ns}	2.59	3.89
Error	16	0.02	0.00			
TOTAL	26	0.03				

^{ns} – not Significant Coefficient of Variance = 14.81%