BIBLIOGRAPHY

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ABSTRACT

The study was conducted at the Benguet State University, Balili experimental area in La Trinidad Benguet to evaluate yield, profitability and farmers acceptability of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet; identify the best variety of pole snap bean suitable for organic production system in La Trinidad, Benguet; and document organic production practices in La Trinidad, Benguet.

Blue Lake had significantly higher fresh pod yield than Alno, the check variety. Blue Lake, Tublay, CPV 60, CPV 64, and Kapangan had higher return on cash expense than Alno. For fresh pod production, growing all the ten varieties of pole snap bean for fresh pod production resulted in positive ROCE. For seed production, Blue Lake and Kapangan out yielded the check variety, Alno. Varieties Blue Lake, Kapangan, CPV 69 and Tublay had higher return on cash expense. All the varieties of pole snap bean evaluated except Mabunga were accepted by the farmers. As a result of this study, Blue Lake, Kapangan, Tublay and CPV60 were the best varieties of pole snap bean suitable for organic production system in La Trinidad, Benguet.

INTRODUCTION

Snap bean (*Phaseolus vulagaris* L.) of the legume family is an annual, warm-season crop grown primarily for its young, edible and fleshy pods and/or seeds. It is botanically classified as dicotyledonous crop (Aerts, 2000).

There are two types of snap bean grown by farmers in Benguet: the pole snap bean or climbing bean that develop long twined, rarely branched indeterminate stems so it is grown with poles or trellises to support the vines; and the bush snap bean which produces short, erect, much-branched, and determinate stem. The leaves of both type consists of three leaflets. The pods vary in shape and color according to the variety (Kebasen, 2000).

Snap beans are being grown as good source of income for most farmers in Benguet. Aside from that, legume seeds are especially important as a complement to carbohydrate staples such as rice and corn and could be a cheap substitute for protein containing foods such as meat and fish when these becomes scarce and expensive (Shresta, 1989). Also, due to increasing nitrogen fertilizer cost, beans belonging to legumes which have the capacity to fix nitrogen could be a good intercrop to provide nitrogen for the next crop (Rai, 1986). With these benefits, production of snap beans must be increased and one important factor to increase production is to consider the variety suited to the production system and environmental conditions.

Farmers tend to increase their production by intensive application of chemical pesticides and synthetic fertilizers but such practices contributed to several problems like soil degradation, water contamination, air pollution, resistance of insect pest and diseases and imbalance in nature which leads to further reduction of yield, income, destruction of the ecosystem and health risks to human being.

Due to these problems, an environmental friendly system of farming must be considered. One of which is organic farming which does not employ the use of chemical pesticides and fertilizers. It is important to farm organically to increase long-term soil fertility, to control pests and diseases without harming the environment, to ensure that water stays clean and safe, to use resources which the farmer already has, so the farmer needs less money to buy farm inputs and finally, to produce nutritious food, feed for animals and high quality crops to sell at a good price (The Organic Organization, 1998).

It is important to introduce high yielding, acceptable, and resistant varieties of pole snap beans. Although many studies have already been conducted, it is important to continue to test varieties with characteristics appropriate to organic production, rather than high yielding and disease resistance properties alone.

The result of this study, if significant, could help convince farmers go on organic production of pole snap beans and will help organic farmers identify varieties which are high yielding, resistant to pest and diseases, acceptable to growers, and profitable under organic production system.

The study aimed to evaluate fresh pod and seed yield of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet, evaluate profitability of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet, evaluate farmers acceptability of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet, identify the best variety of pole snap bean suitable for organic production system in La Trinidad, Benguet; and document organic production practices in La Trinidad, Benguet.

The study was conducted at the organic farm of Benguet State University, Balili, La Trinidad, Benguet from October 2012 to March 2013.

REVIEW OF LITERATURE

The Plant

Snap bean belongs to the Leguminose family. It originated from tropical America. It is an annual crop adapted to a wide range of soil (Martin and Leonard, 1970). In addition, pole snap beans have twinning vine. The leaves usually have three leaflets and the flowers are pea-like. The pods and seeds often are flattened. The string beans whose pods are eaten are varieties of kidney bean (Collier and McMillan, 1966).

The demand for bean as a staple protein diet has been growing, while the yield of this crop has decreased in recent years because of several biotic and abiotic stresses. Therefore, evaluation of germplasm for yield and resistance traits is needed (Maiti, 1997).

Legumes

Legumes are the largest and most widespread flowering plants. It is of particular value to the farmer and gardener because the plant enriches the soil in which they grow in nitrogen compounds that are synthesized from atmospheric nitrogen by means of bacteria which lives in nodules developed on the roots. It is also of special value to housewives because the ripe or dry seeds contain a high proportion of protein and vitamin B (Herklots, 1972). In addition, food legumes are comparatively rich in lysine and therefore a combination of cereal protein and legume protein comes very close to providing an ideal source of dietary proteins for human being (Siegal and Favcett, 1976).

Organic Farming

Organic farming works in harmony with nature rather than against it. This involves using techniques to achieve good crop yields without harming the natural environment or the people who live and work in it. Organic farming does not mean going ‘back’ to traditional methods. Many of the farming methods used in the past are still useful today. Organic farming takes the best of these and combines them with modern scientific knowledge (The Organic Organization, 1998). Furthermore, organic gardening is not just about using what is natural and making use of everything that the environment has to offer. But one must consider also that shifting into an organic form of food production simply means a temporary disruption of your cropping cycle, needless to say, shedding ample amount of money in order to go for the organic way **(**Eco Philippines, 2011**)**.

Lockie *et al*. (2006) stated that the key healthy plants, animals and people, are the diversity of life forms found on the soil. The key to successful farming therefore, is to feed the soil not the plant. Organic food and fiber are produced and grown using practices that enhance soil health, biodiversity, and natural ecological processes of nutrient energy recycling, that allow animals to act out natural patterns and behavior and which reduce the impacts of farming on the wider landscape. Organic food contain less harmful additives and more primary and secondary nutritious than conventional foods and carries no additional risks of food poisoning. Conventional foods are more likely to be contaminated with potentially dangerous fungi than are organic food.

Organic production system is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in which preference to the use of off-farm inputs, taking into account the regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system (Lockeretz, 2007).

Acceptability of Varieties to Farmers

A farmer has to select for the right variety that suits his own condition and consumer needs as well (HARRDEC, 1996). Rasco and Amante in 1994 stated that Varietal evaluation is ultimately measured in terms of the variety that passed the evaluation process by the end users. Varietal trial can be done directly by assessing available plant traits or plant product characteristics that are perceived to be related to the evaluation objectives. Moreover, a farmer may initially accept a new variety because it suits his farming practice and he finds it to be better yielding than his traditional variety but many stop growing it if he finds out that many traders are not willing to buy it. Conventional varietal testing focuses on agronomic performance (traits like yield, duration, and disease resistance) but farmers consider many other features of a variety when deciding whether or not to adopt it. Farmers may also be concerned with weed competitiveness, harvestability and storability. These factors are very hard to evaluate in variety testing programs, but maybe strongly related to farmers decisions on adoption. Many farmers rely almost entirely on their own seed supply for planting material, and on their friends, relatives, and neighbors for new germplasm. They may be unaware of or have no access to improved varieties (IRRI, 2003).

Snap bean quality is a combination of appearance and physical condition. The beans should be well formed, uniform, straight, crisp, have good color and no defects. Except for color and length there is little distinction among varieties. Horticultural beans and other specialty beans may be purple or variegated. Green snap beans are light, medium or dark green. Dark colored beans tend to mask some russeting and other minor defects that are more evident on light colored beans. Curved pods and pods with missing seeds are the most common defects in shape. Slightly curved pods are not a quality problem, however the more the pods are curved the less uniform they appear. Straight pods provide a better appearance. The percentage of curved pods increases in plants with pods set low in the plants or plants that lodge allowing pods to touch the soil (Neibauer J. and E. Maynard, 2002).

Tolerant or resistant varieties, which remain the backbone of organic agriculture, provided that the available varieties with resistance are acceptable to growers and consumers (Lockeretz, 2007).

Varietal Evaluation

Before a variety is recommended, it has to undergo series of varietal evaluation. Variety evaluation is the process of determining the value of a given variety or a set of varieties. Varietal evaluation is important in order to observe performance characteristics such as yield, earliness, vigor, maturity and keeping quality because different varieties have wide range of differences in plant size and yield performance. Thus; the variety to be selected should be high yielding, insect and disease resistant and early maturing (HARRDEDC 1996). Thompson (1957) also stated that testing of the varieties to find the most adapted to local conditions is very essential. He even mentioned that other characteristics such as size, shape, resistance to pest and diseases and other factor should be taken into consideration in determining the most promising variety. He stated that testing of varieties is of greater importance than testing purity and germination. It is essential for the farmer to find the suited variety or strain of some crops and recommended varieties to determine whether or not fit to a particular condition or market.

It is necessary to know the comparative merits or value of the different varieties which furnish the materials for selection. Once this is known, selection will consist in the choice and use of the best variety. If the varieties in the question are grown for a long time by a farmer, he is likely to be familiar with the comparative performance of the varieties and no further test maybe necessary. However, when the varieties under question is new in the farm, it will be necessary to perform comparative test of this varieties for several season to determine which the best of them is and which should be selected (Mendiola 1958).

Trials are an inexpensive and effective way to expose farmers to new germplasm. Variety trials conducted on the research station are often managed very differently from farmers practice. Trials which are conducted on on-farm and under the complete management of farmers provide information about the performance of new varieties under the real conditions faced by farmers (IRRI, 2003). New varieties are found to be not only unexpectedly flavorsome, but also no trouble to grow (Bonar, 1994).

When selecting varieties for organic production systems, the criteria needs to take into account a much wider array of factors, which amongst others includes market, yield, rotational position of the crop and height, early development characteristics and establishment rate, canopy cover, and leaf shape size and altitude to stem (Briggs, 2008).

In 1993, Gonzales reported that five local varieties of pole snap bean were grown in Benguet namely: Stonehill, Kentucky wonder, Burik, Alno and Patig. His finding showed that Burik had the most number of pickings. In contrast, Bolislis (2004) observed that Burik had the least count of pods.

On the other hand, in the study of Dawaten in 1999, Stonehill and Burik had significantly longer pods compared with Black Valentine.

Muchino (2007) found that the six varieties of snap bean grown under Kabayan, Benguet condition differed in their yielding potential. Violeta and Blue Lake performed significantly better than other varieties in terms of pod cluster per plant, pod per plant and weight of marketable pods. Furthermore, Calya-en (2009) stated that among the 10varieties of pole snap beans evaluated in Mankayan, Benguet, Blue Lake B-21, CPV60 and CPV 69 were the earliest varieties to be harvested in 75 DAS. Mabunga, Blue Lake, and Taichung had the highest pod cluster per plant while HAB 71 had the highest percentage of pod setting.

Cayso (2005) stated that among the varieties she evaluated, they did not significantly show differences on percentage survival, days to flowering, number of flower per cluster, and percent pod set. B-21, Stonehill, Taichung, and Violeta were observed to have mild resistance to pod and bean rust. Blue lake, Macarao, and B-21 exhibited higher yield potential.

Soil and Climatic Requirements

Beans are traditionally a sub-tropical or temperate crop. Beans tolerate conditions in tropical and temperate zones but do poorly in very wet tropics where rain cause disease and flower drop. Blossom-up is serious above 35^{o}C (Duke, 1993). In addition, Navazio *et al.* in 2007 stated common bean is a tender, warm season crop that requires warm, well drained soils for germination. Temperatures of 21-27^{o}C are preferred for optimum crop growth. Temperatures above 90°F or below 50°F during flowering may adversely affect pod set and seed yields. Most snap bean cultivars germinate best when soil temperatures are at or above 65°F (12°C.), but germination may be inhibited at temperatures above 95°F (35°C). There are instances when seed growers must plant with soil temperatures below optimum in order to fully mature a seed crop by the end of the season.

Snap bean beans are adaptable to a wide variety of soil types but have difficulty emerging in crusted soils. The use of a rotary hoe is sometimes necessary on heavy soils to break the crust. Uniform emergence is particularly important for bush type beans that will be mechanically harvested. For this reason, all areas of the field must be well drained and prepared with no crusted, cold or wet areas. Snap beans prefer a well-drained, fertile soil with a pH of 5.8 to 7.0. Beans are particularly sensitive to boron and may experience toxicity problems in fields where boron is naturally high. Snap beans will nodulate and form symbiotic associations with nitrogen-fixing bacteria in the soil even without artificial inoculation. Modern cultivars require fertilizer nitrogen for best performance; however, plants fixing their own nitrogen often get off to a slower start in the cool spring weather and are less uniform in bloom time and subsequent number of days to harvest (Anderson, 2001).

Seed Production

There are very few stages in snap bean growth in which differences within a variety are apparent. If the seed is planted into uniform soil tilt and moisture then it is possible to perform early selection for speed of emergence, uniformity of the stand, and overall vigor, which are essential traits for organic production. By routinely rouging out late emerging, low vigor seedlings there will be improvement over cycles of selection for these traits.

Proper timing of harvest is important in order to produce high quality bean seed that is fully mature, has a high germination percentage and has maximum storage potential. Each variety has its own specific harvest timing and while this makes overall recommendations for gauging cutting, curing, and threshing difficult, there are basic signs that indicate maturity. The initial signal that the crop is ready to cut is the relative maturity of the pods and their color at or near the time when they are breaking, or when they first haven't gone to the tan, papery shade. Maturation to the brown, papery stage increases danger of seed shattering during harvest. Pods should generally be yellow at harvest in order to mature properly in the windrow, but the exact desired color may be variety-specific. The crop should be cut when approximately 70 to 80% of the pods on the crop are of the desired color and point of breaking. Typically, the stems of the crop are undercut mechanically just below the soil surface during the early morning when there is dew on the plants, and may be left in place for a day before windrowing. The next day the plants are raked into windrows, preferably with some dew on the plants to prevent shattering or damaging the pods (Navazio *et al.*, 2007).

The most favorable time for harvesting bean seed is normally 90 - 110 days after planting depending on the variety grown. When all leaves and pods of upright bush beans are yellow, you know that the plants are ready for harvesting. Harvest pods of climbing and trailing beans as they mature. Rapid harvest of the seed reduces to a minimum their deterioration in the field, infestation by insects and losses from physical damage. It is not advisable to harvest pods in contact with the soil. Do not dry beans on the ground. This way they can get dirty, wet, or eaten by animals. You can dry beans in their pods on a mat. It is better to dry them on a plastic sheet, raised platform or in a maize crib (FoDiS, 2009).

MATERIALS AND METHODS

An area of $337m^2$ was thoroughly prepared and divided into three blocks consisting of 30 plots with a dimension of 0.75m x 5m. Three plots were allotted to a treatment in each replication. The two outer plots were used for seed production and the inner plot was for fresh pod production. The study was laid-out in a randomized complete block design (RCBD) with three replications.

Two seeds of pole snap bean were sown per hill in a double row plot at a distance of 25cm x 25cm between hills and between rows (Fig. 1). All cultural management practices for organic production of pole snap beans in La Trinidad, Benguet such as: basal application of vermi-compost at a rate of 3000kg/ha (Fig. 2), trellising (Fig. 3), hilling-up just after side-dress of vermi-compost at a rate of 1000kg/ha(Fig. 4), leaf pruning or leaf thinning i.e. removal of infected and infested leaves (Fig. 5) as cultural pest control and spraying of Lacto Acid Bacteria Serum (Fig. 6) as organic fungicide were followed and documented. Soil sampling was done before and after the experiment to determine the soil properties of the experimental area. Standard seed production technology which is harvesting the first and last pods of the plant as fresh pod and prime harvesting for seeds was followed.

The following varieties of pole snap bean that were obtained from Benguet State University- Institute of Plant Breeding Highland Crops Research Station (BSU-IPB HCRS) served as treatments.

TREATMENT	VARIETIES
V1	Alno (check)
V2	Blue Lake
V3	Kapangan
V4	Mabunga
V5	Patig
V6	Tublay
V7	B-21
V8	CPV 60
V9	CPV 64
V10	CPV 69

Figure 1. Planting of the ten pole beans varieties under organic production system in La Trinidad, Benguet

Figure 2. Land preparation (left) and basal application of vermicompost (right) under organic production system in La Trinidad, Benguet

Figure 3. Incorporation of vermi-compost to the soil (left) and trellising (right) on the ten varieties of pole snap bean under organic production system in La Trinidad, Benguet

Figure 4. Side-dressing of vermicompost on the ten varieties of pole snap bean under organic production system in La Trinidad, Benguet

Figure 5. Trimming or leaf pruning of the ten varieties of pole snap bean under organic production system in La Trinidad, Benguet

Figure 6.Organic fungicide used for the control of bean rust (Lacto acid bacteria serum) on the ten varieties of pole snap bean under organic production system in La Trinidad, Benguet

Data Gathered

1. Agro-climatic data. Monthly mean minimum and maximum temperature, relative humidity, rainfall and sunshine duration prevailing over the experimental area were collected at the BSU/PAGASA, Agronomical- Meteorological station during the period of the study.

2. Description of the location. This was the topography and elevation including the cropping system/history employed in the area which were asked from the previous farmer or manager who used the area.

3. Soil chemical properties. Sampling of soil was done before and after the experiment and they were analyzed at the Regional Soil Laboratory in San Fernando City for its chemical properties.

4. Number of days from sowing to emergence. This was taken by counting the number of days from planting up to the time when at least 50% of plants per treatment emerged.

5. Percentage germination. This was computed using the following formula:

$$\text{Percentage germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

6. Percentage survival. This was computed using the following formula:

$$\text{Percentage survival (\%)} = \frac{\text{Number of plants survived}}{\text{Number of seeds sown}} \times 100$$

7. Number of days from emergence to flowering. This was determined by counting the number of days from emergence to the time at least 50% of the plant per treatment have fully opened flowers.

8. Number of days from emergence to first harvesting of fresh pod. This was taken by counting the number of days from emergence to first harvesting of fresh pods.

9. Number of days from emergence to last harvesting of fresh pod. This was taken by counting the number of days from emergence to the last harvest of fresh pods.

10. Number of flowers per cluster. This was recorded by counting the number of flowers per cluster from ten sample cluster per treatment.

11. Number of pods per cluster. The number of pods per cluster was obtained by counting the number of pods produced from ten sampled cluster per treatment used for gathering number of flower per cluster.

12. Percentage pod set per cluster (%). This was obtained using the following formula:

$$\text{Percentage pod setting (\%)} = \frac{\text{Number of flower/cluster}}{\text{Number of pods/cluster}} \times 100$$

13. Number of seeds per pod. The number of seeds per pod was counted from ten sample pods per treatment.

14. Pod length (cm). This was taken by measuring the length in cm of ten sample pods from the pedicel end to the blossom end using a foot rule.

15. Pod width (cm). This was taken by measuring the width of the broadest portion of ten sample pods per plot.

16. Pod straightness. This was recorded from visual observation as either straight or curved pod.

17. Pod shape. This was recorded visually whether it is a round or flat pod.

18. Pod color. This was observed visually when the pods were fully developed.

19. Weight of marketable fresh pods per plot (kg/3.75m^2). This was gathered by weighing the pods that are straight and free from insect pest damage and disease infection.

20. Weight of non-marketable fresh pods per plot (kg/3.75m^2). This was gathered by getting the weight of pods that are abnormal in shape and damaged by insect pest and diseases.

21. Total fresh pod yield per plot (kg/3.75m^2). The over-all total weight of marketable and non-marketable pods was obtained by getting the sum of all the weight of marketable and non-marketable yield throughout the harvesting period.

22. Computed fresh pod yield per hectare (t/ha). This was computed using the formula:

$$\text{Fresh pod yield (tons/ha)} = \text{Total yield/plot (kg/3.75m}^2\text{)} \times 2.67$$

where 2.67 was the factor used to convert fresh pod yield in kg/3.75m^2 plot to t/ha.

23. Seed length (cm). Ten sample seeds was randomly selected from each treatment will be measured using a foot rule.

24. Seed width (cm). The mid portion of the seed was measured using a foot rule.

25. Seed diameter (cm). The diameter of the seed was measured at harvest from ten sample seeds selected at random. This will be measured parallel to the haulm using a vernier caliper.

26. Weight of marketable seeds per plot (kg/7.5m^2). This was obtained by weighing the marketable seeds that are infected with disease, malformed and damaged by insect pest.

27. Weight of non-marketable seeds per treatment (kg/7.5m^2). This was obtained by weighing non-marketable seeds that were damaged, small sized, and infested with pest.

28. Weight of 200 seeds (g). This was obtained by weighing 200 good seeds per treatment.

29. Total seed yield per plot (kg/7.5m^2). This was obtained by taking the sum of marketable and non-marketable seeds per plot.

30. Computed seed yield per hectare (t/ha). This was computed using the following formula:

Seed yield (tons/ha) = total fresh pod yield/plot (kg/m^2) x 1.33

Where 1.33 was the factor used to convert seed yield in kg/7.5m^2 to tons/ha.

31. Reaction to bean rust, fusarium root rot and pod borer. This was determined at peak of harvesting stage using the respective rating scale for bean rust infection and pod borer infestation used at BSU-IPB by Tandang *et al*. (2008) as follows:

a. Bean rust

Scale	Percent Infestation	Remarks
1	Less than 20% infection per plot	highly resistant
2	20-40% infection per plot	moderately resistant
3	41-60% infection per plot	mildly resistant
4	61-80% infection per plot	Susceptible
5	61-80% infection per plot	very susceptible

b. Pod borer

Scale	Percent Infestation	Remarks
1	Less than 20% infection per plot	highly resistant
2	20-40% infection per plot	moderately resistant
3	41-60% infection per plot	mildly resistant
4	61-80% infection per plot	Susceptible
5	61-80% infection per plot	very susceptible

c. Fusarium root rot

Scale	Percent Infestation	Remarks
1	Less than 20% infection per plot	highly resistant
2	20-40% infection per plot	moderately resistant
3	41-60% infection per plot	mildly resistant
4	61-80% infection per plot	Susceptible
5	61-80% infection per plot	very susceptible

32. Return on cash expense (ROCE). The return on cash expense for fresh pod production and seed production were obtained separately by using the following formula:

$$\text{ROCE} = \frac{\text{Net income}}{\text{Total expense}} \text{ X } 100$$

33. Farmers acceptability. Ten farmers were invited to make their own selection of the ten pole snap bean varieties evaluated. Selection was based on fresh pod straightness, color, shape, taste and general acceptability after harvest. Hedonic scale for sensory evaluation used by Tandang in 1998 as follows was used.

Scale	Description	Remark
1		Dislike Extremely
2		Dislike Very much
3		Dislike Moderately
4		Dislike Slightly
5		Neither like nor dislike
6		Like slightly
7		Like moderately
8		Like very much
9		Like extremely

<u>Analysis of Data</u>

The data gathered were tabulated and statistically analyzed using the analysis of variance (ANOVA) for randomized complete block design (RCBD) with three replications. The significance of differences among treatments were tested using Least Significant Difference (LSD) at 5% and 1% level of significance.

RESULTS AND DISCUSSION

Agro- climatic Data

Table 1 shows the minimum and maximum monthly temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study from November 2012 to February 2013. Minimum temperature ranged from 11.8^{o}C to 18.9^{o}C while maximum temperature ranged from 17.5^{o}C to 22.6^{o}C and the relative humidity ranged from 68 to 86.5. According to Narvazio, J. *et al*. in 2007, Temperatures ranging from 21°C-27°C is required for optimum crop growth of pole snap bean.

Total amount of rainfall was recorded at 1.33 mm in November 2012 then it declined in the succeeding month which is observed to be insufficient for growing pole snap bean. Thus, irrigation was done at four days interval from planting.

According to Terry in 1999, Snap beans need bright sunshine duration for eight hours (480 minutes) every day. During the conduct of the study, total bright sunshine duration ranged from 121.18 min to 360 min or a mean of 285.10min which was shorter

Table 1. Agro-climatic conditions taken during the conduct of the study (PAG-ASA) in La Trinidad, Benguet

MONTH	TEMPERATURE (^{0}C)		RELATTIVE HUMIDITY (%)	AMOUNT OF RAINFALL (mm)	SUNSHINE DURATION (min)
	MIN	MAX			
NOVEMBER	13.10	20.90	84.75	1.33	329.00
DECEMBER	13.20	22.60	86.50	0.15	121.18
JANUARY	18.90	20.10	80.00	0.50	360.00
FEBRUARY	11.80	17.50	68.00	0.29	330.20
MEAN	14.25	20.28	79.81	0.57	285.10

than sunshine duration required in growing pole snap beans. Shortest sunshine duration was recorded in December 2010 which coincided with the flowering stage of the different varieties of pole snap beans evaluated.

Description of the Location

The area planted belonged to the zero to three percent slope category of barangay Balili which is described to be level to nearly level and it has an elevation of 1,336m above sea level. The barangay where the study was conducted has an average minimum temperature of 16 ^{o}C and maximum of 26^{o}C. It is classified under type 'A' climate.

According to farmers interviewed who have been previously tilling the area, the area where the study was conducted was previously planted with lettuce varieties such as romaine and green ice, and bush snap bean followed by pole snap beans and green lettuce the next cropping. After that, the area was fallowed for about six months before the study was conducted. Processed chicken manure, sunflower juice mixed with chicken dung, and urea were previously applied on the area.

Soil Chemical Properties

Table 2 shows the chemical properties of soil in the area where the experiment was conducted. The soil in the area was medium textured. Medium textured soils are well drained soils that have typically good soil aeration meaning that the soil contains air that is similar to atmospheric air, which is conducive to healthy root growth, and thus, a healthy crop (Berry, 2007).

Table 2. Soil chemical properties

SAMPLE FIELD	TEXTURE	pH	ORGANIC MATTER (%)	NITROGEN (%)	PHOSPHORUS (ppm)	POTASSIUM (ppm)
Before	Medium	6.20	1.50	7.5	120	180
After	Medium	6.30	1.50	7.5	90	210

Soil pH was originally 6.20 before planting which was according to Watkins in 2004, a best pH for growing snap beans pole after the experiment. In contrast, percentage of potassium increased after the experiment however, the pH was raised to 6.30 after the experiment. Organic matter as well as nitrogen percentage of 1.50 and 7.5 respectively, remained as is. Percentage of phosphorus before planting was lowered.

Percent Germination and Percentage Survival

Among the varieties tested, the study shows that only CPV 69 had significantly higher percentage germination than Alno, the check variety which had comparable percentage germination to all the other varieties tested (Table 3).

There was no significant difference observed between the varieties tested with the check variety, Alno. All the ten varieties of pole snap bean studied produced comparable percent germination ranging from 56.95 to 80.56 (Table 3).

Although high percentage germination was noted among the ten varieties of pole snap bean, lower percentage survival was recorded among the varieties evaluated due to infection of the area with *Fusarium solani f. sp. phaseoli.*

Table 3. Percent germination and survival of ten pole snap bean varieties evaluated under organic production system in La, Trinidad, Benguet

VARIETIES	GERMINATION (%)	SURVIVAL (%)
Alno (check)	85.28[a]	65.84
Blue Lake	88.91[a]	65.84
Kapangan	87.92[a]	79.44
Mabunga	87.92[a]	84.58
Patig	83.47[a]	68.47
Tublay	85.70[a]	69.31
B-21	86.52[a]	78.89
CPV-60	91.25[a]	80.56
CPV-64	83.47[a]	56.95
CPV-69	91.39[b]	73.61
CV (%)	3.46	16.61
LSD (.01)	6.06*	ns

Means within a column, means followed by "a" are not significantly different; and means in a column followed by "b" are significantly higher than Alno

Number of Days from Sowing to Emergence and from Emergence to Flowering and First and Last Harvesting of Fresh Pods

Table 4 shows that among the varieties evaluated, Blue Lake, Mabunga, and Patig emerged one day earlier than Alno. This could be attributed to the varietal characteristics of the test materials studied. The other varieties emerged within seven days which is the same with Alno.

In terms of days from emergence (DAE) to flowering, highly significant difference was observed between the varieties of pole snap bean evaluated and Alno (Table 4). All the other varieties flowered earlier except for Mabunga. B-21 flowered at 36 DAE followed by Kapangan and CPV 60 which flowered one day later and others flowered two to four days later. Alno and Mabunga were the latest to flower at 41 DAE.

Table 4. Number of days from sowing to emergence and from emergence to flowering, first harvest and last harvest of ten pole snap bean varieties grown under organic production system in La Trinidad Benguet.

VARIETIES	NUMBER OF DAYS FROM SOWING TO EMERGENCE	NUMBER OF DAYS FROM EMERGENCE TO		
		FLOWERING	FIRST HARVESTING OF FRESH POD	LAST HARVESTING OF FRESH POD
Alno (check)	7^{a}	41^{a}	61^{a}	93^{a}
Blue Lake	6^{b}	38^{b}	61^{a}	89^{b}
Kapangan	7^{a}	37^{b}	61^{a}	83^{b}
Mabunga	6^{b}	41^{a}	62^{c}	84^{b}
Patig	6^{b}	38^{b}	62^{c}	92^{b}
Tublay	7^{a}	40^{b}	60^{b}	83^{b}
B-21	7^{a}	36^{b}	60^{b}	88^{b}
CPV-60	7^{a}	37^{b}	61^{a}	93^{a}
CPV-64	7^{a}	40^{b}	61^{a}	93^{a}
CPV-69	7^{a}	40^{b}	62^{c}	93^{a}
CV %	2.6	0.77	0.33	0.19
LSD (.01)	0.54**	0.88**	0.57**	0.08**

Means in a column followed by "a" are not significantly different; means in a column followed by "b" are significantly earlier; and "c" are significantly later than the check variety, Alno.

Table 4 also shows that in terms of DAE to first harvesting of fresh pod Tublay and B-21 significantly were first harvested one day earlier than Blue Lake, Kapangan, CPV 60 and CPV 64 which were first harvested along with the check variety, Alno. Mabunga, Patig and CPV 69 were the latest to be harvested for fresh pod yield at 62 DAE.

Highly significant difference was observed in terms of days from emergence to last harvesting of fresh pod among the between the nine varieties of pole snap bean tested and Alno. Majority of them were harvested one to ten days earlier than Alno which was last harvested 93 DAE like those of CPV 60, CPV 64, and CPV 69 (Table 4).

Pod Length and Pod Width, and Number of Seeds per Pod

As shown in Table 5, among the ten varieties of pole snap bean evaluated, only Mabunga had significantly longer pods than Alno. And in terms of pod width, only B-21 significantly produced narrower pods than Alno.

On the number of seeds per pod, all the varieties evaluated except CPV 60 produced eight seeds per pod which was one seed greater than Alno. CPV 60 had similar number of seeds with Alno (Table 5).

Number of Flowers and Pods per Cluster

Blue Lake, Tublay and CPV 64 produced eight flowers per cluster which was significantly higher than Alno (Table 6). Other varieties had comparable number of flowers per cluster with Alno. On the number of pods per cluster, Blue Lake, Kapangan, Tublay, B-21 and CPV 60 also produced greater number of pods per cluster than Alno, the check variety. Other varieties had comparable number of pods per cluster with Alno (Table 6).

Table 5. Pod length and width, and number of seeds per pod of ten varieties of pole snap beans evaluated under organic production system in La Trinidad, Benguet

VARIETIES	POD LENTH (cm)	POD WIDTH (cm)	NUMBER OF SEEDS PER POD
Alno (check)	14.82[a]	11.83[a]	7[a]
Blue Lake	13.75[a]	12.27[a]	8[b]
Kapangan	14.63[a]	11.07[a]	8[b]
Mabunga	16.69[b]	12.3[a]	8[b]
Patig	14.28[a]	11.57[a]	8[b]
Tublay	14.61[a]	12.00[a]	8[b]
B-21	14.03[a]	10.27[b]	8[b]
CPV-60	14.53[a]	12.67[a]	7[a]
CPV-64	13.91[a]	11.93[a]	8[b]
CPV-69	14.04[a]	11.77[a]	8[b]
CV %	4.46	3.18	.01
LSD (.01)	1.31**	1.09**	0.22**

Means in a column followed by "a" are not significantly different; and means in a column followed by "b" are significantly higherthan the check variety, Alno.

Figure 7. Fresh pod of the ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet

<u>Percent Pod Set per Cluster</u>

As also shown on Table 6, Tublay, B-21, Blue Lake, Mabunga, and CPV 60 had significantly higher percentage pod set than Alno. Only Patig numerically had lower percentage pod set per cluster than Alno. Other varieties had comparable pod setting percentage with Alno.

Table 6. Number of flowers and per cluster, and percent pod set per cluster of ten varieties of pole snap bean

VARIETIES	NUMBER OF		% POD SET PER CLUSTER
	FLOWERS PER CLUSTER	PODS PER CLUSTER	
Alno (check)	7[a]	3[a]	50.00[a]
Blue Lake	8[b]	6[b]	73.81[b]
Kapangan	7[a]	5[a]	64.88a
Mabunga	7[a]	4[a]	72.70[b]
Patig	7[a]	3[a]	44.29[a]
Tublay	8[b]	6[b]	82.74[b]
B-21	7[a]	5[b]	80.16[b]
CPV-60	7[a]	5[b]	69.84[b]
CPV-64	8[b]	4[a]	56.55[a]
CPV-69	7[a]	3[a]	50.00[a]
CV %	4.54	12.96	9.75
LSD (.05)	0.93**	1.72**	18.49**

Means in a column followed by “a” are not significantly different; and means in a column followed by “b” are significantly higher than the check variety, Alno.

Pod Straightness, Shape, and Color

In terms of pod straightness, all pole snap bean varieties evaluated were observed to have straight pods, except for Mabunga and Patig which had slightly curved pods. Blue Lake, Kapangan, Mabunga, and Patig had round pods while the rest had flat pods. All varieties produced green pods except for Mabunga which had purple pods (Table 7). This could be due to unique varietal characteristic of Mabunga.

According to Neibauer and Maynard in 2002, beans should be well formed, straight, and have good color. For color and length there is little distinction among varieties. Slightly curved pods are not a quality problem, however the more the pods are curved the less uniform they appear.

Weight of Marketable, Non-marketable and Total Fresh Pod per Plot (kg/3.75m^2) and Computed Fresh Pod Yield per Hectare (t/ha)

Snap bean quality is a combination of appearance and physical condition. The beans should be well formed, uniform, straight, crisp, have good color and no defects in order to be considered marketable (Neibauer and Maynard, 2002).

Table 7. Pod straightness, shape, and color of the ten varieties of pole snap bean evaluated

VARIETIES	POD		
	STRAIGHTNESS	SHAPE	COLOR
Alno (check)	straight	flat	green
Blue Lake	straight	round	green
Kapangan	straight	round	green
Mabunga	Slightly curved	round	purple
Patig	Slightly curved	round	green
Tublay	straight	flat	green
B-21	straight	flat	green
CPV-60	straight	flat	green
CPV-64	straight	flat	green
CPV-69	straight	flat	green

Blue Lake significantly produced the heaviest weight of marketable fresh pod per plot among the varieties of pole snap beans evaluated (Table 8). Statistical analysis revealed no significant difference in marketable fresh pods per plot between other varieties and Alno, the check variety.

All the ten varieties of pole snap bean studied produced comparable non-marketable fresh pods that ranged from 0.74kg/3.75m^2 to 0.96kg/3.75m^2 (Table 8).

Table 8. Fresh pod yield per plot and computed yield per hectare of the ten varieties of pole snap beans evaluated

VARIETIES	FRESH POD YIELD PER PLOT (kg/3.75m^2)			COMPUTED FRESH POD YIELD PER HECTARE (t/ha)
	MARKETABLE	NON-MAKETABLE	TOTAL	
Alno (check)	3.72[a]	0.89	4.61[a]	3.28[a]
Blue Lake	7.14[b]	0.96	8.10[b]	5.76[b]
Kapangan	4.48[a]	0.82	5.30[a]	3.77[a]
Mabunga	2.46[a]	0.90	3.36[a]	2.39[a]
Patig	2.77[a]	0.81	3.50[a]	2.55[a]
Tublay	4.94[a]	0.82	5.76a	4.10[a]
B-21	3.80[a]	0.78	4.58[a]	3.26[a]
CPV-60	4.85[a]	0.74	5.59[a]	3.98[a]
CPV-64	4.56[a]	0.84	5.40[a]	3.85[a]
CPV-69	3.54[a]	0.96	4.51[a]	3.21[a]
CV %	14.38	15.00	14.2	7.70
LSD (.05)	1.80**	ns	2.10**	1.49**

Means in a column followed by “a” are not significantly different; and means in a column followed by “b” are significantly higher than the check variety, Alno.

Figure 8. Marketable fresh pod (left) and non-marketable fresh pod (right) of ten varieties of pole snap beans evaluated under organic production system in La Trinidad, Benguet

Statistically, among all the varieties evaluated, only Blue Lake significantly out yielded the check variety, Alno. The other varieties had statistically similar total fresh pod yield per plot with Alno (Table 8).

Among all the varieties of pole snap beans evaluated, only Blue Lake at significantly higher computed fresh pod yield per hectare (t/ha) than Alno which only recorded 3.28 t/ha of fresh pod yield (Table 8).

Seed Length (cm), Width (cm), and Diameter (cm)

Comparing the other varieties of pole snap beans evaluated with Alno, Tublay, CPV 60, CPV 64, and CPV 69 had significantly longer seeds (Table 9).

Statistical analysis shows no significant difference in seed width between Alno and the varieties evaluated (Table 9). It ranged from 0.75cm to 0.92cm.

Highly significant difference in seed diameter was observed between the ten varieties evaluated and Alno (Table 9). Mabunga and Blue Lake were recorded to have statistically smaller seeds. Other varieties had comparable seed diameter with Alno (Table 9).

Table 9. Seed length, width, and diameter of the ten varieties of pole snap bean evaluated

VARIETIES	SEED			WEIGHT OF 200 SEEDS (g)
	LENGTH(cm)	WIDTH (cm)	DIAMETER (cm)	
Alno(check)	1.28^{a}	0.68	0.65^{a}	68.33a
Blue Lake	1.25^{a}	0.63	0.60^{b}	57.67^{c}
Kapangan	1.34^{a}	0.71	0.68^{a}	73.33^{b}
Mabunga	1.24^{a}	0.62	0.59^{c}	57.67^{c}
Patig	1.24^{a}	0.67	0.65^{a}	68.33^{a}
Tublay	1.40^{b}	0.66	0.70^{b}	64.33^{a}
B-21	1.33^{a}	0.70	0.65^{a}	62.33^{a}
CPV-60	1.40^{b}	0.69	0.68^{a}	65.67^{a}
CPV-64	1.38^{b}	0.67	0.65^{a}	61.00^{c}
CPV-69	1.37^{b}	0.75	0.69^{a}	70.33^{a}
CV %	0.16	0.66	2.18	3.58
LSD (.01)	0.06**	ns	0.05**	6.83**

Means in a column followed by “a” are not significantly different; and means in a column followed by “b” are significantly higher than the check variety, Alno.

Weight of 200 Seeds (g)

Significantly heavier weight of 200 seeds was recorded in Alno than Blue Lake, Mabunga and CPV 64. Other varieties had comparable 200 seed weight with Alno (Table 9).

Figure 9. Seeds of the ten varieties of pole snap beans evaluated under organic production system in La Trinidad, Benguet

Weight of Marketable, Non-marketable and Total Seed Yield per Plot (kg/7.5) and Computed Seed Yield per Hectare (t/ha).

Table 10 shows that among the varieties of pole snap beans evaluated, only Blue Lake had significantly heavier weight of marketable seeds per $3.75m^2$ while Patig had lower marketable seed yield. All other varieties have comparable marketable seed yield with Alno.

Statistical analysis revealed highly significant difference between all the varieties evaluated except Blue Lake and Kapangan that produced higher total seed yield per plot than Alno while Patig and B-21 had significantly lower total seed yield per plot (Table 10).

Table 10. Seed yield per plot and computed seed yield per hectare of the ten varieties of pole snap beans evaluated

VARIETIES	SEED YIELD PER PLOT ($kg/7.5m^2$)			COMPUTED SEED YIELD PER HECTARE (t/ha)
	MARKETABLE	NON-MAKETABLE	TOTAL	
Alno(check)	1.32[a]	0.03[a]	1.35[a]	0.24[a]
Blue Lake	1.93[b]	0.08[b]	2.01[b]	0.36[b]
Kapangan	1.54[a]	0.09[b]	1.63[b]	0.29[a]
Mabunga	1.18[a]	0.02[a]	1.20[c]	0.21[a]
Patig	0.74[b]	0.04[a]	0.78[b]	0.14[a]
Tublay	1.28[a]	0.01[a]	1.30[a]	0.23[a]
B-21	0.95[a]	0.01[a]	0.96[c]	0.17[a]
CPV-60	1.08[a]	0.03[a]	1.11[c]	0.20[a]
CPV-64	1.12[a]	0.02[a]	1.13[c]	0.20[a]
CPV-69	1.35[a]	0.05[a]	1.40[a]	0.25[a]

CV %	0.21	2.15	7.24	19.38
LSD (.01)	0.52**	0.05**	0.14**	0.11**

Means in a column followed by "a" are not significantly different; and means in a column followed by "b" are significantly higherthan the check variety, Alno.

Figure 10. Marketable seeds (upper) and non-marketable seeds (lower)of the ten varieties of pole snap beans evaluatedunder organic production system in La Trinidad, Benguet

As shown on Table 10, all the varieties evaluated had comparable computed seed yield per hectare with Alno except for Blue Lake which had significantly higher computed seed yield per hectare.

Only Kapangan and Blue Lake had highly significant difference in weight of non-marketable seeds per plot with Alno (Table 10).

Weight of Marketable, Non-marketable and Total Yield per Plot (kg/7.5m^2), and Computed Fresh Pod Yield (t/ha) Harvested from Plots Intended for Seed Production

To improve seed quality of pole snap beans (personal communication with Dr. Tandang, 2013), the first two to three pods of the plant must be harvested to direct more nutrients in the succeeding pods. So in this study, harvesting of pods was done twice in all the plots. Thus, this data on fresh pod was gathered.

There was highly significant difference on the weight of marketable fresh pod per plot between the varieties of pole snap bean evaluated and Alno (Table 11). Mabunga and Patig had significantly lower weight of marketable fresh pod per 7.5m^2 than Alno. The other varieties had comparable weight of marketable fresh pod with the check variety, Alno.

Table 11 Showed that Blue Lake, Mabunga, Patig, B-21 and CPV 69 had significantly lower weight of non-marketable fresh pods per 7.5m^2 than Alno. All the other varieties have comparable weight of non-marketable seeds per plot.

In terms of total fresh pod yield per plot, Mabunga and Patig were significantly lower than Alno (Table 11). All the other varieties had comparable total fresh pod yield with the check variety, Alno.

Table 11. Fresh pod of ten varieties of pole snap bean evaluated harvested from plots intended for seed production

VARIETIES	FRESH POD YIELD PER PLOT ($kg/7.5m^2$)			COMPUTED FRESH POD YIELD PER HECTARE (t/ha)
	MARKETABLE (kg)	NON-MAKETABLE (kg)	TOTAL (kg)	
Alno(check)	1.00[a]	0.22[a]	1.22[a]	0.43[a]
Blue Lake	1.32[a]	0.07[b]	1.39[a]	0.50[a]
Kapangan	1.12[a]	0.17[a]	1.29[a]	0.46[a]
Mabunga	0.26[c]	0.03[b]	0.29[c]	0.10[c]
Patig	0.33[c]	0.06[b]	0.39[a]	0.14[a]
Tublay	1.43[a]	0.15[a]	1.58[a]	0.56[a]
B-21	1.06[a]	0.10[b]	1.16[a]	0.41[a]
CPV-60	1.44[a]	0.16[a]	1.59[a]	0.57[a]
CPV-64	1.25[a]	0.12[a]	1.37[a]	0.49[a]
CPV-69	1.01[a]	0.09[b]	1.10[a]	0.39[a]
CV %	18.25	10.50	11.10	7.24
LSD (.01)	0.83**	0.09**	0.89**	0.32**

Means in a colum followed by “a” are not significantly different; means followed in a column by “b” are significantly higher; and “c” is significantly lower than the check variety, Alno.

There was highly significant difference on the weight of marketable fresh pod per plot between the varieties of pole snap bean evaluated and Alno (Table 11). Mabunga and Patig had significantly lower weight of marketable fresh pod per $7.5m^2$ than Alno. The other varieties had comparable weight of marketable fresh pod with the check variety, Alno.

There was highly significant difference on the weight of marketable fresh pod per plot between the varieties of pole snap bean evaluated and Alno (Table 11). Mabunga and Patig had significantly lower weight of marketable fresh pod per 7.5m^2 than Alno. The other varieties had comparable weight of marketable fresh pod with the check variety, Alno.

Table 11 Showed that Blue Lake, Mabunga, Patig, B-21 and CPV 69 had significantly lower weight of non-marketable fresh pods per 7.5m^2 than Alno. All the other varieties have comparable weight of non-marketable seeds per plot.

In terms of total fresh pod yield per plot, Mabunga and Patig were significantly lower than Alno (Table 11). All the other varieties had comparable total fresh pod yield with the check variety, Alno.

Table 11 showed that only Mabunga had significantly lower computed fresh pod yield per hectare than Alno. All the other varieties had comparable computed fresh pod yield per hectare with the check variety, Alno.

Bean Rust Infection

In terms of bean rust infection, all varieties evaluated were rated to be moderately resistant than Alno and Patig except for Mabunga which were rated as mildly resistant (Table 12).

Pod Borer Infestation

Alno, BlueLake, Kapangan, Tublay, CPV 60, CPV 64, and CPV 69 were rated to be moderately resistant while B-21 and Patig were observed to be mildly resistant to pod borer. Mabunga is found to be susceptible to pod borer (Table 12).

Fusarium Root Rot

Symptoms of fusarium root rot were observed on pole snap bean varieties evaluated. All varieties were observed to be moderately resistant to fusrium root rot except for Blue Lake which is rated to be mildly resistant (Table 12).

Table 12. Pod borer infestation, bean rust and fusarium root rot infection of ten varieties evaluated under organic production system in La Trinidad, Benguet

VARIETIES	BEAN RUST INFEECTION	POD BORER INFESTATION	FUSARIUM ROOT ROT INFECTION
Alno	Susceptible	Moderately resistant	Moderately resistant
Blue Lake	Moderately resistant	Moderately resistant	Mildly resistant
Kapangan	Moderately resistant	Moderately resistant	Moderately resistant
Mabunga	Mildly resistant	Susceptible	Moderately resistant
Patig	Susceptible	Mildly resistant	Moderately resistant
Tublay	Moderately resistant	Moderately resistant	Moderately resistant
B-21	Moderately resistant	Mildly resistant	Moderately resistant
CPV 60	Moderately resistant	Moderately resistant	Moderately resistant
CPV 64	Moderately resistant	Moderately resistant	Moderately resistant
CPV 69	Moderately resistant	Moderately resistant	Moderately resistant

Figure 11.Susceptibility to bean rustof the ten varieties of pole snap beans evaluatedunder organic production system in La Trinidad, Benguet

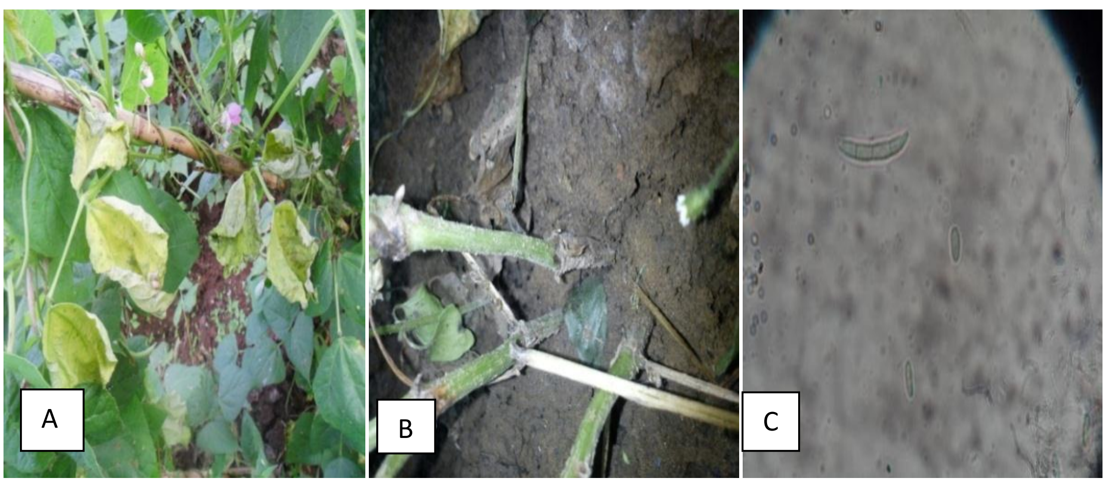

Figure 12. Symptoms of Fusarium root rot. (A) Wilting, (B) resting spores on roots, (C) microscopic structureof the ten varieties of pole snap beans evaluatedunder organic production system in La Trinidad, Benguet

Farmer's Acceptability

In terms of pod color, all varieties were liked very much by farmers except Mabunga which was rated neither liked nor disliked. Alno, Blue Lake, Kapangan, Mabunga, B-21 and CPV-64 were liked moderately while the rest were liked slightly in terms of shape. The size of Blue Lake and Mabunga were liked by farmers than Alno. When it comes to taste, all the varieties were liked slightly by farmers but in terms of general acceptability, all varieties were liked very much except for Mabunga which was neither liked nor disliked by most of the farmers.

Figure 13. Farmer's evaluating the ten pole snap bean varieties evaluated under organic production system in La Trinidad, Benguet

Table 13. Result of evaluation of the ten pole snap bean varieties by ten farmers

VARIE-TIES	COLOR	SHAPE	SIZE	TASTE	GENERAL ACCEPTA-BILITY
Alno	Liked very much	Liked moderaely	Liked moderaely	Liked slightly	Liked very much
Blue Lake	Liked very much	Liked moderaely	Liked very much	Liked slightly	Liked very much
Kapangan	Liked very much	Liked moderaely	Liked moderaely	Liked slightly	Liked very much
Mabunga	Neither liked nor disliked	Liked moderaely	Like very much	Liked slightly	Neither liked nor disliked
Patig	Liked very much	Liked slightly	Liked moderaely	Liked slightly	Liked very much
Tublay	Liked very much	Liked slightly	Like moderaely	Liked slightly	Liked very much
B-21	Liked very much	Liked moderaely	Liked moderaely	Liked slightly	Liked very much
CPV-60	Liked very much	Liked slightly	Like slightly	Liked slightly	Liked very much
CPV-64	Liked very much	Liked moderaely	Liked moderaely	Liked slightly	Liked very much
CPV-69	Liked very much	Liked slightly	Like slightly	Liked slightly	Liked very much

<u>Return on Cash Expense on
Fresh Pod Production</u>

Table 14 shows the cost and return analysis for fresh pod production of ten varieties of pole snap bean evaluated under organic production in La Trinidad, Benguet. Blue Lake garnered the highest percentage on ROCE at 337.84% followed by Tublay, CPV 60, CPV 64, and Kapangan. Patig and Mabunga showed lower ROCE than Alno.

Table 14. Return on Cash Expenses (ROCE) on fresh pod production of ten pole snap beans varieties evaluated under organic production system in La Trinidad, Benguet

VARIETIES	MARKETABLE PODS (kg/3.75m^2)	GROSS SALE (PhP)	TOTAL EXPENSE (PhP)	NET INCOME (PhP)	ROCE (%)
Alno(check)	4.61	277	111	166	149.19
Blue Lake	8.10	486	111	375	337.84
Kapangan	5.30	318	111	207	186.49
Mabunga	3.36	202	111	91	81.62
Patig	3.50	210	111	99	89.19
Tublay	5.76	346	111	235	211.35
B-21	4.58	275	111	164	147.57
CPV-60	5.59	335	111	224	202.16
CPV-64	5.40	324	111	213	191.89
CPV-69	4.51	271	111	160	143.78

Selling price for fresh pod: PhP 50/kg

<u>Return on Cash Expense on Seed Production</u>

Blue Lake, Kapangan, Tublay, CPV 60 and CPV 64 have higher percentage of return on cash expense than Alno (Table 15).

It is observed that varieties with high fresh pod yield also had high seed yield.

Interestingly, growing all the varieties of pole snap bean evaluated could be profitable under organic production system in La Trindad, Benguet.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at the organic farm of Benguet State University, Balili, La Trinidad Benguet to evaluate yield of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet; evaluate profitability of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet; evaluate farmer's acceptability of ten varieties of pole snap bean grown under organic production system in La Trinidad, Benguet; identify the best variety of pole snap bean suitable for organic production system in La Trinidad, Benguet; and identify the best variety of pole snap bean suitable for organic production system in La Trinidad, Benguet; and document organic production practices in La Trinidad, Benguet.

In almost all the parameters measured, there were highly significant differences comparing nine other varieties of pole snap bean with the check variety, Alno. CPV 69 had higher germination percentage. Blue Lake, Mabunga and Patig emerged one day earlier. All the varieties flowered earlier except for mabunga. Tublay and B-21 was first harvested with fresh pod one day earlier while Mabunga and Patig were later. Mabunga significantly have longer pod while B-21 have broader and except CPV 60, all the varieties have more number of seeds per pod than Alno. Blue Lake, Tublay, and CPV 64 had greater number of flowers per cluster. Blue Lake, Mabunga, Tublay, B-21 and CPV 60 had higher percentage pod set. Tublay, CPV 60, CPV 64, and CPV 69 significantly have broader seeds. Blue Lake and Mabunga had smaller while Tublay had the bigger seeds. Blue Lake, Mabunga and CPV 64 had lesser weight of 200 seeds.

Alno, Blue Lake, Kapangan, Tublay, CPV 60, CPV 64, and CPV 69 were rated to be moderately resistant to pod borer. Blue Lake, Kapangan, Tublay, B-21, CPV 60, CPV 64, and CPV 69 were moderately resistant to bean rust. All varieties were observed to be moderately resistant to fusarium root rot except for Blue Lake which was recorded to be mildly resistant.

Based on fresh pod yield performance, Blue Lake had higher weight of marketable fresh pods, total yield, and computed yield per hectare than Alno. It had also gained the highest return on cash expense followed by Tublay, CPV 60, CPV 64, and Kapangan.

Based on seed yield performance, Blue Lake had higher weight of marketable seeds per plot and computed seed yield per hectare as compared to Alno. On total yield per plot, Blue Lake and Kapangan had higher seed yield. Blue Lake gained the highest return on cash expenses followed by Kapangan, CPV 69, and Tublay.

All varieties except Mabunga were generally liked very much by farmers.

Conclusion

Based on the results of the study, Blue Lake have higher fresh pod yield than the check variety, Alno. In terms of ROCE for fresh pod, Blue Lake, Tublay, CPV 60, CPV 64, and Kapangan is higher than Alno.

Based on seed yield performance, Blue Lake and Kapangan outyielded the check variety, Alno. Also, Blue Lake, Kapangan, CPV 69 and Tublay had higher ROCE for seed production than Alno.

All the pole snap bean varieties evaluated except Mabunga are acceptable to farmers in La Trinidad, Benguet.

Blue Lake, Tublay, CPV 60, CPV 64 and Kapangan for fresh pod production and Blue Lake, Kapangan, CPV 69 and Kapangan for seed production are therefore the most suitable varieties of pole snap for organic production system in La Trinidad Benguet.

Recommendation

Blue Lake, Kapangan, Tublay and CPV 69 are recommended for seed production; and Blue Lake, Tublay, CPV 60, CPV 64 and Kapangan are recommended for fresh pod production under organic production system in La Trinidad, Benguet.

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