BIBLIOGRAPHY

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Adviser: Guerzon A. Payangdo, MSc.

ABSTRACT

The study was conducted at Benguet State University Experimental area in Balili, La Trinidad, Benguet with the following objectives: (1) to determine the seed yield of the bush snap bean varieties applied with different organic fertilizers; (2) to identify the best organic fertilizer for seed yield production of bush snap bean; (3) to determine the fertilizer and variety interaction; and, (4) determine the profitability of growing bush snap bean applied with different organic fertilizers.

On the application of different organic fertilizers, no significant differences were recorded in all the parameters observed. Contender and Bokod produced the highest yield. Plants applied with BSU compost and Azolla compost produced the heaviest seeds.

However, in terms of profitability, variety Contender not applied with fertilizer gave the highest return on cash expenses followed by variety Bokod applied with Azolla compost.

INTRODUCTION

Bush snap bean (*Phaseolus vulgaris* L.) is one of the vegetable legumes cultivated in many parts of the world. It has high productivity compared to the other types of beans. The plant is also an excellent source of protein, vitamins and others that is important to human health (Tawang, 2003).

The nutritive quality of bush beans partly contributes to the solution of malnutrition problems in the country. Aside from the benefits it directly provides to farmers, it is also beneficial in maintaining soil productivity due to the capacity of its roots to fix atmospheric nitrogen to make the soil fertile (Gonzales, 1983).

Since bush bean is an important vegetable crop, production should be increased by using good quality of seed and suitable varieties (Palasi, 2008).

It has also been observed that farmers do not give proper attention to fertilization in the production of bush beans. Farmers apply either too high or too low amounts of fertilizer needed by the plant. Thus, improper fertilizer application leads to higher expenses and low profit (Wasing, 2011).

Organic fertilizers are considered to be more environmental friendly than synthetic fertilizers. Organic fertilizers contain fewer amounts of the major plant nutrients like nitrogen, phosphorous, potassium; however, it contain micronutrients and humus that promote good physical, biological conditions in the soil for plant growth (Palasi, 2008).

In this regard, the evaluation of bush bean varieties applied with different organic fertilizers may help solve fertilizer shortage, soil degradation, and minimize production cost.

The study aimed to:

1. determine the seed yield of the bush snap bean varieties applied with different organic fertilizers,

2. identify the best organic fertilizer for seed yield production of bush snap bean;

3. determine the fertilizer and variety interaction; and,

4. determine the profitability of growing bush snap bean applied with different organic fertilizers.

The study was conducted from November 2012 to February 2013 at Balili Experimental Station, Benguet State University, La Trinidad, Benguet.

REVIEW OF LITERATURE

Seed Production

Bush bean are grown for their dry seeds, others are grown for their fresh pods with young immature seeds for canning purposes as a market product. Thus, bush snap beans require six to seven weeks to mature in warm weather they can grow successfully in area with fairly short summer (Agayao, 2002).

Seed production is a specialized type of a crop production. It requires functional background in plant breeding and seed technology to ensure the production of high quality of seed technology to ensure the production of high quality of seed in term of genetic purity and physical quality such as seed size, freedom from abnormalities and seed borne diseases (Hampton, 1987).

As mentioned by Bautista and Mabessa (1997) selecting the right variety will minimize problems associated with water and fertilizer management. The variety to be selected should be high yielding, pest and diseases resistant, and early maturing so that production would entail less expense, and ensure more profit.

Moreover, PCARRD (1982) cited that seeds must be harvested when start to yellow or begin to dry up with the wine to avoid diseases. In storing seeds, they are first thoroughly dried before shelling after which the seeds maybe air dried to 3 to 5 hours before putting them in air tight containers and stored in a cool dry area. And also newly shelled peas should not be dried under direct sunlight.

Source of Organic

Matter animal manure, crop products, green manures or legumes, azolla and blue-green algae, industrial waste and garbage commercial fertilizer and peat soil are the various source of organic fertilizers. Animal manure is the most common organic fertilizers used by vegetable farmers. Examples are the guano, chicken dung, cow hog, carabao and horse manure. Crop by product such as rice straw, corn stubbles and sugar cane tops and leaves can be used as a material in the production of organic fertilizers (Abad, 2009).

Daizel *et al.* (2007) mentioned that organic matters are formed from dead animals and plants. It always contains carbon, oxygen and hydrogen. However it has the ability to hold a lot of moisture and can attract up to ten times more plants that the clay minerals. Organic matter could be identified into two fractions; one is composed of fresh decaying materials consisting of roots systems and leaves of dead plants and waste materials of animals, insects and small animals living in the soil. Another part of the decomposed fresh materials is stabilized through the formation of clay organic compound. In these compound the organic matter is protected from the activity of enzymes and further decomposition is recorded (Hignett, 1985).

Benefits of Using Organic Fertilizer

Organic matter when added to the soil has numerous beneficial affect which include increased soil fertility, balanced supply of nutrients and build up of organic materials, the nutrient content and process of the decomposition in the soil. Soils with moderate amounts of organic matter are well aggregated and posses good tilt, water infiltration and retention (PCARRD, 1991).

Organic matter can play a major role retaining potassium, calcium and magnesium. Most organic fertilizers such as mushroom compost, alnus compost, vermi compost, chopped sunflowers and others provide various nutrients to the soil. For example, wild sunflower has been known as a good source of organic nitrogen.

There is increasing evidence to show that the addition of organic matter to the soil, especially in the form of compost, increase the rate of mineralization of nitrogen, phosphorus, and potassium. There is also evidence that trace elements which are applied to connect deficiencies will be more readily available to crops and will exert a longer lasting effect if compost has also been given (Daizell *et al.*, 2007).

Organic fertilizer mushroom is low in potassium but rich in nitrogen, phosphorus, calcium and other secondary element. Since it is composed of sawdust with some materials like limestone and rice bran it has carbon as main source of energy for activities of soil microorganisms like rhizoid for nitrogen fixation and mycorrhizae for increasing the availability of soil phosphorus. Soil treatment with sawdust, tree leaves, green manure soil cake on rice bran promotes the multiplication of earthworm and inhibits nematodes population.

As a result almost all plant growing in compost amended soil is healthier or more productive than they would be without compost (Baul and Kourik, 1992).

Application of organic fertilizers helps conserve the soil, maintain and sustain crop quality and productivity and protect the environment. The additions of organic matter in the soil increase the soil ability to hold water preventing erosion and cracking. It loosens the soil resulting in better soil property and increase compaction resistance compost fertilizers can buffer the soil against rapid change due to acidity, alkalinity, pesticides and toxic metals (Chen, 2005).

Studies in china also should positive effect of compost on soil porosity, bulk density, stickiness and water absorption (PCARRD, 2006).

Seed production is a specialized type of crop production. It requires not only background in plant breeding but also in technology. This will ensure the production of high quality seed in term of genetic purity and physical quality such as seed size freedom from abnormalities and seed borne diseases (Windo, 2005).

Effect of Organic Fertilizer on plant

Koshimo (1990) found that nutrient elements from organic fertilizer are released slowly which is particularly important in avoiding salt injury, ensuring a continuous of nutrients during the growing season and in producing products of better quality.

Anselmo (1996) found that plants applied with 3 t/ha of organic fertilizer showed the least percentage infection of plant disease. On the other hand, increase percentage infection was observed in plants applied with 15 t/ha high percentage infection of bacterial wilt was also observed in plants not applied with organic fertilizer.

Oryan (1997) revealed that excessive application of compost affects the severity of bacterial infection because the abundance of nutrients would prolong vegetative growth and delay maturity, making it more susceptible to pathogen.

MATERIALS AND METHODS

An area of 180 square meters was thoroughly cleaned, prepared and divided into three blocks with 12 plots per replication measuring 1m x 5m. This was laid out in Split-Plot Design arranged in Randomized Complete Block Design (RCBD) with three replications.

The bush snap bean varieties and organic fertilizers served as the treatments. The different types of organic fertilizers were assigned as the main plot while the bush snap bean varieties were the sub-plot as follows:

Main Plot (Organic Fertilizer- OF)	
OF_0	Control
OF_1	BSU compost
OF_2	Azolla compost
OF_3	Alnus compost

Sub Plot (Bush Snap Bean- V)	Source
Contender	BPI
Bokod	BPI
Sablan	BPI

The nutrient analyses of the fertilizers are the following:

BSU compost

Composition:

Nitrogen	1.50%	Organic carbon	19.23%

Phosphorous	2.50%	Moisture content	30%
Potassium	2.56%	Magnesium	1.70%
Calcium	10.30%		

Azolla compost

Nitrogen	4-5%	Iron	0.06-0.26%
Phosphorous	0.5-0.6%	Manganese	0.11-0.16%
Potassium	2-4%	Magnesium	0.5-0.6%
Calcium	0-4%		

Alnus compost

Nitrogen	25%	Organic matter	50%
Phosphorous	7.0%		
Potassium	3-3.6%		

All cultural management practices such as weeding, irrigation and pest control were strictly employed uniformly in all treatments to ensure proper growth and development of the crop.

Data Gathered

1. Meteorological data. Temperature and relative humidity were taken by using the compact psycho meter. Rainfall was taken by placing cans in the field to collect water when precipitation occurs. The volume of water collected was measured using the graduated cylinder and was recorded by getting the average volume of the water from the cans.

2. Number of days from sowing to emergence. This was gathered when 75% of plants has emerged or by counting the number of days from sowing to emergence.

3. Number of days from sowing to flowering. This was determined by counting the days from sowing up to the time when 50% of plants per plot starts to produce flowers.

4. Number of days from sowing to pod setting. This was obtained by counting the days from emergence until the appearance of small pods.

5. Number of days from sowing to first harvest. This was recorded by counting the days from sowing to first seed harvest.

6. Number of days from sowing to last seed harvest. This was taken by counting the days sowing to last seed harvesting.

7. Initial and Final Height (cm). This was recorded by measuring five sample plants. Initial height was recorded at 2 weeks after planting and final height was recorded just before the first seed harvest.

8. Plant vigor. This was recorded using CIP rating scale (Jose, 2004)

Scale	Description	Remarks
1	Plants are weak with few stems and leaves: very pale	Poor vigorous
2	Plants are weak with few thin stems and leaves pale	Less vigorous
3	Better then less vigorous	Vigorous
4	Plants are moderately strong with robust stem and leaves are light green color	Moderately vigorous
5	Plants are strong with robust stems and leaves, leaves are light to dark in color	Highly vigorous

9. Weight of marketable seed (kg). This was determined by weighing the smooth, undamaged, and good seeds free from pests and diseases.

10. Weight of non-marketable seed (kg). This was obtained by weighing all seeds that are disease malformed or damaged.

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

12. Computed seed yield (tons/ha). This was computed using the formula:

$$\text{Seed yield (ton/ha)} = \frac{\text{Total yield per plot (kg)}}{\text{Plot size}} \times 2$$

Where 2 is constant to convert the plot yield (kg) into ton/ha

13. Reaction to bean rust and pod borer. This was determined using the scale on bean rust and pod borer.

a. Bean rust (Jose, 2004)

Scale	Description	Remarks
1	No infection per plot	Highly resistant
2	1-25% infections per plot	Mild resistant
3	25-50% infections per plot	Moderately resistant
4	51-75% infections per plot	Susceptible resistant
5	76-100% infections per plot	Very susceptible

b. Pod borer (Jose, 2004)

Scale	Description	Remarks
1	No infestation per plot	Highly resistant
2	1-25% infestations per plot	Mild resistant
3	25-50% infestations per plot	Moderately resistant
4	51-75% infestations per plot	Susceptible resistant
5	76-100% infestations per plot	Very susceptible

14. Return on cash expense (ROCE). This was computed by using the following formula:

$$\text{ROCE} = \frac{\text{Net income}}{\text{Total cost Production}} \times 100$$

Data Analysis

All quantitative data were analyzed using the Analysis of variance (ANOVA) for Split-Plot Design arranged in Randomized Complete Block Design (RCBD) with three replications. The Duncan's Multiple Range Test (DMRT) was used to determine the significance of differences among the treatment means.

RESULTS AND DISCUSSION

Meteorological Data

Shown in Table 1 is the meteorological data which include the maximum and minimum temperature (^oC), relative humidity (%), amount of rainfall (mm), and sunshine duration (min) throughout the conduct of the study. The maximum and minimum temperature was observed in the months of November to February.

Relative humidity was highest in December and the lowest was during the months of January and February. The monthly rainfall ranged from 0.29mm to 1.33mm. The longest sunshine duration was observed during the month of January 2013 (360.0 min) and the shortest sunshine duration was recorded in the month of November 2012 (10.97 min). Swieden and Ware (2002) cited that for rapid uniform emergence, bean seeds should be planted in warm soils. Bush beans grow best in soils that have a temperature range from 15^oC to 29^oC with an optimum temperature of 27^oC for seed germination. Below 10^oC, the growth and maturation of the crop slows down. If beans are grown in cool, wet soil, germination will be delayed and seed may rot.

Table 1. Temperature, relative humidity, rainfall and sunshine duration during the conduct of the study (November 2012 to February 2013).

MONTH	TEMPERATURE (^oC)		RELATIVE HUMIDITY (%)	RAINFALL (mm)	SUNSHINE DURATION (min.)
	MIN.	MAX.			
NOVEMBER	13.1	20.9	84.75	1.33	10.97
DECEMBER	13.2	22.6	86.5	0.15	12.18
JANUARY	18.3	23.7	80	0.5	360
FEBRUARY	17.5	11.8	68	0.29	330.2

Source: PAGASA Office, BSU, La Trinidad, Benguet

Number of days from Sowing to Emergence, Flowering and Pod Setting

Effect of organic fertilizer. Table 2 shows no significant differences among the organic fertilizers in relation to emergence, flowering and pod setting.

Effect of variety. No significant differences were noted among the varieties of bush snap beans used in the study (Figure 1). All varieties emerged eight days from sowing, flowered after 44 to the days and set pod after 46 to 47.75 days.

Interaction effect. There was no significant interaction observed among the different organic fertilizers on the days to emergence, flowering, and pod setting of bush snap beans (Table 2).

Table 2. Number of days from sowing to emergence, flowering, and pod setting and flowering of the bush snap bean varieties applied with different organic fertilizers

TREATMENT	DAYS FROM SOWING TO		
	EMERGENCE	FLOWERING	POD SETTING
Organic fertilizer			
Control	8	49.0	50.00
BSU compost	8	42.0	44.00
Azolla compost	8	44.0	46.00
Alnus compost	8	47.0	49.00
Varieties			
Contender	8	44.5	46.25
Bokod	8	46.0	47.75
Sablan	8	46.0	47.75
(O x V)	ns	ns	ns

Figure 1. Bush snap bean plants at 8 DAP.

Number of Days from Sowing to First Harvest
and Last Harvest

Effect of organic fertilizer. The use of different organic fertilizers did not significantly differ on the number of days from sowing to the first seed harvest and the last harvest as shown in Table 3.

Effect of variety. Bush snap bean varieties did not significantly affect the number of days from sowing to the first seed harvest and last seed harvest. All the varieties were first harvested at 87 days and 90 days after sowing as the pods were fully matured and half dried.

Interaction effect. The different organic fertilizers and varieties showed no interaction on the number of days from sowing to first seed harvest and number of days from sowing to last seed harvest.

Initial and Final height (cm)

Effect of organic fertilizer. There were no significant differences observed on both initial and final height of plants applied with different organic fertilizers.

Effect of variety. The three bush snap bean varieties were not significantly different in both initial and final height (Table 5). However numerically, Sablan had the highest initial and final height.

Interaction effect. There was no significant interaction noted on both organic fertilizers and varieties on the initial and final height of the different bush snap bean varieties used in the study.

Table 3. Number of days from sowing to first and last seed harvest of the bush snap bean varieties applied with different organic fertilizers

TREATMENT	DAYS FROM SOWING TO	
	FIRST HARVEST	LAST HARVEST
Organic fertilizer		
Control	87	90
BSU compost	87	90
Azolla compost	87	90
Alnus compost	87	90
Varieties		
Contender	87	90
Bokod	87	90
Sablan	87	90
(O x V)	ns	ns

Table 4. Initial and final height of the bush snap bean variety applied with different organic fertilizers

TREATMENT	HEIGHT (cm)	
	INITIAL (15 DAP)	FINAL (85 DAP)
Organic fertilizer		
Control	88	237
BSU compost	87	275
Azolla compost	86	253
Alnus compost	90	250
Varieties		
Contender	87	255
Bokod	87	249
Sablan	89	257
(OxV)	ns	ns
CV_a (%)	7.08	11.24
CVb (%)	3.17	6.42

*Means with the same letters are not significantly different at 5 % level using DMRT.

Plant Vigor

Effect of organic fertilizer. Table 6 shows no significant differences observed on plant vigor in relation to the different organic fertilizers applied. Plants applied with Alnus compost were vigorous while the rest were moderately vigorous.

Effect of variety. The plant vigor of the different bush snap bean varieties revealed no significant differences. However, Sablan was vigorous while Bokod and Contender were moderately vigorous.

Table 5. Plant vigor applied with different organic fertilizers

TREATMENT	PLANT VIGOR
Organic fertilizer	
Control	Moderately vigorous
BSU compost	Moderately vigorous
Azolla compost	Moderately vigorous
Alnus compost	Vigorous
Varieties	
Contender	Moderately vigorous
Bokod	Moderately vigorous
Sablan	Vigorous

Sample Seed Weight, Weight of Marketable Seed (g),
and Non- Marketable Seed (g)

Effect of organic fertilizer. No significant differences on the weight of 200 seeds were noted. On the weight of marketable seeds, plants applied with BSU compost had the significantly heaviest marketable seeds which was comparable with plants applied with Azolla and Alnus compost. On the non- marketable yield, no significant differences were observed.

Effect of variety. No signicant differences were noted on the weight of sample seeds and non-marketable seeds. On the weight of marketable seeds, Bokod variety produced significantly the heaviest seed of 457 g/m^2 which was comparable with Contender (449 g/m^2) followed by Sablan variety 411 g/m^2 (Figures 3-4).

Interaction effect. No significant interaction effect was observed on the weight of sample of seeds, marketable seeds and non- marketable seeds of bush snap bean varieties applied with different organic fertilizers.

Table 6. Sample seed-weight, weight of marketable seed and weight of non- marketable seed of bush snap bean varieties applied with different organic fertilizers

TREATMENT	SAMPLE SEED WEIGHT (200)(g)	WEIGHT OF MARKE - TABLE SEEDS (g/m^2)	WEIGHT OF NON-MARKETABLE SEEDS ($g/5m^2$)
Organic fertilizer			
Control	1.29	344^{b}	25
BSU compost	1.37	522^{a}	22
Azolla compost	1.30	470^{ab}	25
Alnus compost	1.37	419^{ab}	22
Varieties			
Contender	1.34	449^{ab}	22
Bokod	1.33	457^{a}	24
Sablan	1.33	411^{b}	25
(O x V)	ns	ns	ns
CV_a (%)	4.74	17.38	19.60
CV_b (%)	4.86	8.82	10.11

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

Figure 2. Marketable seeds of Contender variety

Figure 3. Marketable seeds of Bokod variety

Figure 4. Marketable seeds of Sablan variety

Total Seed Yield per Plot

Effect of organic fertilizer. The application of BSU compost significantly gave the highest total seed yield per plot (544 g/m$^{2)}$ was comparable with Azolla compost (405 g/m^2) and Alnus compost (441 g/m^2). The lowest total seed yield was recorded in plants not applied with fertilizer. The significant differences were attributed to the differences in nutrient content of the fertilizers applied.

Effect of varieties. Among the varieties used, Bokod variety significantly gave the highest total yield of 480.17 kg/m^2 but comparable with Contender (475 kg/m^2). Sablan variety produced the lowest total seed yield.

Interaction effect. There was no significant interaction effect between fertilizers and varieties on the total seed yield.

Computed Seed Yield

Effect of organic fertilizer. The computed seed yield per hectare showed significant differences, wherein plants applied with BSU compost had the heaviest yield of 212.73 tons/ha. The computed seed yield of plants applied with Azolla compost and Alnus compost were comparable.

Effect of variety. The three bush snap bean varieties were significantly different in terms of computed seed yield per hectare. Bokod and Contender varieties registered the heaviest computed seed per hectare (Table 8).

Interaction effect. No significant interaction effect on computed seed yield was observed between the different organic fertilizers and the three varieties of bush snap beans used in the study.

Table 7. Total seed yield per plot and computed seed yield per hectare of bush snap bean varieties applied with different organic fertilizers

TREATMENT	TOTAL SEED YIELD PER PLOT ($g/5m^2$)	COMPUTED SEED YIELD (t/ha)
Organic fertilizer		
Control	375^{b}	150^{b}
BSU compost	544^{a}	213^{a}
Azolla compost	405^{ab}	198^{ab}
Alnus compost	441^{ab}	176^{ab}
Varieties		
Contender	475^{ab}	190^{a}
Bokod	480^{a}	188^{a}
Sablan	435^{b}	174^{b}
(OxV)	ns	ns
CVa (%)	16.77	16.18
CV_b (%)	8.69	7.66

*Means with the same letters are not significantly different at 5 % level using DMRT.

Reaction to Pod Borer and Bean Rust

Effect of organic fertilizer. Plants applied with different organic fertilizers were mildly to moderately resistant to bean rust and pod borer.

. Effect of variety. The bush snap bean varieties had mild to moderate resistance against bean rust and pod borer.

Table 8. Reaction to bean rust and pod borers of the bush snap bean varieties applied with different organic fertilizers

TREATMENT	BEAN RUST	POD BORER
Organic fertilizer		
Control	Moderately resistant	Mild resistant
BSU compost	Mild resistant	Mild resistant
Azolla compost	Mild resistant	Mild resistant
Alnus compost	Moderately resistant	Mild resistant
Varieties		
Contender	Mild resistant	Mild resistant
Bokod	Mild resistant	Mild resistant
Sablan	Moderately resistant	Mild resistant

Return on Cash Expenses (ROCE)

Table 9 shows the return on cash expense (ROCE) of the different bush snap bean varieties applied with different organic fertilizers.

Based on the Table 9, Contender variety gave the highest ROCE of 215.24 %, followed by Bokod variety with 193.94 % ROCE. Furthermore, plants not applied fertilizer had the highest ROCE of 176.13 %.

Table 9. Cost and return analysis of bush snap bean varieties applied with different organic fertilizers

TREATMENT	SEED YIELD (kg)	GROSS SALE (Php)	TOTAL EXPENSES (Php)	NET PROFIT (Php)	ROCE (%)
Organic fertilizer					
Control	1.309	3.571	999.88	630	176.13
BSU compost	1.121	4.897	1371.16	890.01	162.18
Azolla compost	1.141	4.458	1248.24	930	102.66
Alnus compost	3.371	3.966	1110.48	810	111.29
Varieties					
Contender	1.653	5.906	1653.68	1086.67	215.24
Bokod	1.741	5.762	1613.36	1086.67	193.94
Sablan	1.503	5.224	1462.72	1086.67	143.08

- Total expenses include land preparation, seed cost, cost of organic fertilizer
- Selling price of seeds produced: Php. 280/kg

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The study was conducted at the Balili Experimental Station, Benguet State University, La Trinidad to determine the seed yield of the bush snap bean varieties applied with different organic fertilizers; identify the best organic fertilizer for seed yield production of bush snap bean; and determine the fertilizer and variety interaction; and determine the profitability of growing bush snap bean applied with different organic fertilizers.

Based on the results, it was found out that BSU compost performed better in terms of growth and seed yield than the other organic fertilizers. In terms of plant height no significant differences were observed on the initial height among the varieties. Application of BSU compost and Azolla compost produced the tallest plants at maturity.

As to the plant vigor, bush snap bean applied with BSU compost, Azolla compost and no fertilizer application exhibited a moderately vigorous plant while plants applied with the other organic fertilizers were only vigorous.

Contender and Bokod varieties produced the heaviest marketable seed and highest total and computed seed yield.

Bush snap beans applied with BSU compost and Azolla compost produced the heaviest seeds.

No interaction effect was observed between the organic fertilizers and varieties of bush snap beans in all the parameters evaluated.

In terms of ROCE, plants applied with BSU compost gave the highest ROCE while the plants not applied with fertilizers gave the lowest ROCE.

Conclusions

Based on the results, Contender and Bokod varieties had the highest seed yield. BSU compost and Azolla compost appear to be the best organic fertilizers for the growth and seed yield of bush snap beans.

No application of fertilizer realized the highest return on cash expense.

Recommendations

Contender and Bokod varieties can be recommended for bush snap bean seed production.

Application of BSU compost and Bokod variety is recommended for bush snap bean seed production under La Trinidad, Benguet condition.

Azolla compost could be used as an alternative organic fertilizer for the production of bush snap beans.

LITERATURE CITED

ABAD, F. 2009. Seed Production of Snap Bean cultivar black Valentine as affected by Plant Compost Application. Benguet State University, La Trinidad, Benguet. P. 4-5.

AGAYAO, M.C. 2002. Seed Production of bush bean in a farmer's field as affected by Organic Fertilizer. Benguet State University, La Trinidad, Benguet. P. 6.

ANGRIOS, G.N. 1978. Plant Pathology. Second Edition. Orlando Florida, USA. Academic Press Incorporation. P. 109.

ANSELMO, B.A. 1996. Effect of different kinds of organic fertilizer on the severity of bacterial infection. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 10-11.

BAUL, J. and R. KOURIK. 1992. Environmentally Friendly Gardening Easy Composting. San Ramon, CA 94583-0906. P. 73-74.

BAUTISTA, O.K. and R.C. MABESA. 1997. Vegetable Production. UPLB, College, Los Banos, Laguna. P. 28.

CALUTEN, N.D. 2011. Seed Production of common bean applied with different organic fertilizer. Benguet State University, La Trinidad, Benguet. P. 10-14.

CHEN, A. 2005. Compost Production: A manual for Asian Earner. Food and Fertilizer Technology Center. Taipei 106. Taiwan Roc. P.10-15

DAIZELL, CO. A.J. Biddlestone, K.R. Gray and K.THURAIRAJAN. 2007 Soil Management: Compost Production and use in tropical and subtropical environment. Food and agriculture Organization of the United Natison. Daya publishing House Delhi. P. 1, 2, 95, 100.

GONZALES, E.L. 1953. Characterization yield evaluation of ammur varieties of snap bean.BS Thesis. Benguet State University, LaTrinidad, Benguet. P. 30.

GUERZON, J.S. 2002. Effect Different Rates of Alnus Compost on the Growth and Yield of Bush Bean.BS Thesis. Benguet State University, La Trinidad, Benguet. P. 10.

HAMPTON, J.G. 1987. Seed production of Agronomy/ management lecture notes during the seed certificate courses. Seed Technology center. Massey University. Palmerton North, New Zealand. P. 532.

HIGNETT, P. 1985. Fertilizer Manual International Fertilizer Development Center (TFDA) Muscles shoals, Alabang. USA. P. 11,18,132.

JOSEPH, F.C and E.S. GEORGE. 1978. Seed Production and Marketing. John Wiley and Sons: New York, Inc. P. 232.

LONGBAS, S.S. 2010. Seed Production of common bean (*Phaseolous vulgaris L.*) Applied with alnus compost. Benguet State University, La Trinidad, Benguet. P. 4.

KOSHIMO, S. 1990. The use the organic fertilizer and chemical fertilizers. Bs Thesis. Benguet State University, La Trinidad Benguet. P. 6.

OLANGEY, O.P. 2002. The effect of different organic fertilizer on seed production of common bean. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 6.

ORLANG, J.C. 2008. Seed Yield Performance of Bush Bean Varieties under Cabitin, Mankayan Condition. BS. Thesis. Benguet State University, La Trinidad, Benguet. P. 12.

ORYAN, D. 1997. Vegetable Seed Production. University, Bath, UK. P. 4-5.

PAKIAS, L.J. 2008. Effect of different organic fertilizer on the yield performance of the lettuce (*Lactuca sativa Linn*.) var.Red Wave. P. 5.

PALASI, C. 2008. Response of Snap Bean to Organic Fertilizers. Bs Thesis. Benguet State University, La Trinidad Benguet. P. 35.

PCCARD, 1982. Garden Pea Production, Benguet Techno guide for Garden Pea. Laguna: Philippine Council for agriculture and Resources Research Development. P. 14-15.

PCCARD, 1991. Standard methods of analysis for soil plant tissue water, and fertilizer. Los Banos, Laguna. Philippines. P. 11.

PCARRD, 2006. The Philippine Recommended for Organic Fertilizer Production and Utilization. Department of Science and Technology. Los Banos, Laguna, Philippines. P. 25,118.

SAB-IT, L.S. 1982. Effect of Organic fertilization on the Growth and Yield of gladiolus sp. Mountain State Agricultural College LaTrinidad, Benguet. P. 3, 14, 21.

WASING, S.T. 2011. Growth and yield of Rice cv."Lab-Labi" as affected by organic fertilizer application and age of seedlings. Benguet State University, La Trinidad, Benguet. P. 5.

WINDO, M. 2005. Evaluation of Alno- derived Selections of Snap Bean obtained from Different Source in Benguet. Bs Thesis. Benguet State University, La Trinidad Benguet. P. 5.

TAWANG, L.D. 2003. Harvest and Shelf Life of Bush Bean Applied with Different Organic Compost. Benguet State University, La Trinidad, Benguet. P. 1.

TOLEAN, M.L. 1986. Effect of Different Kinds and Rates of Organic Fertilizer on the Growth and Yield of pole Snap Bean, Benguet State University, La Trinidad, Benguet. P. 17.