BIBLIOGRAPHY

APAN-AN, PELEN D. APRIL 2013. Seed Yield of Bush Snap Bean (*Phaseolus vulgaris* L.) Varieties Applied with Plant Supplements in Taneg, Mankayan, Benguet Condition.

Adviser: Danilo P. Padua, PhD

ABSTRACT

The study was conducted at Taneg, MankayanBenguet to determine the best bush snap bean varieties for seed yield production under Taneg, Mankayan, Benguet condition; determine the best plant supplements applied to bush snap bean varieties; compare the growth and seed yield of bush snap bean varieties applied with plant supplements; and determine the profitability of seed production of bush bean varieties applied with plant supplements in Taneg, MankayanBenguet.

Result showed that Contender had the highest weight of marketable, total and computed seed yield, and ROCE.

Among the plant supplements applied, Vitazyme application resulted in higher total and computed yield, and ROCE.

On the weight of 200-seed variety applied with Abundant harvest had the heaviest weight.

INTRODUCTION

Bush bean (*Phaseolus vulgaris* L.*)* is grown extensively in temperate as well as subtropic regions. It is grown commercially for both fresh pods and seeds. It is also important source of protein, carbohydrates, potassium and iron contents (Doijode, 2001).

In Mankayan, few farmers are planting bush beans as dry seed due to pest and diseases such as bean rust and pod borer. It has also been observed that farmers do not give proper attention to fertilization which may lead to low production and profit (Pang-ot ,2010).

At present, plant supplements have been found to increase the seed yield of bush bean and improve soil structure and fertility. It can also increased profit for the farmers because of better seed quality such as prolonged shelf-life higher density and weight (AgBiotech, 2010).

Researches on application of plant supplement to bush bean reveal that there is a substantial increase in yield (75 % yield increase) compared to untreated plants. This yield gave rise to an additional profit of 5,784.7 pesos/acre (Acosta and Marrero, 2005).

Therefore, evaluation of the seed yield of bush bean varieties applied with different plant supplement should be done.

The study was conducted to:

1. determine the best seed yielding bush bean varieties under Taneg, Mankayan, Benguet;
2. determine the best plant supplement applied to the bush bean varieties;
3. compare the growth and seed yield of bush bean varieties applied with plant supplements; and

4. determine the profitability of seed production of bush bean varieties applied with plant supplements in Taneg, Mankayan, Benguet.

The study was conducted from November 2012 to February 2013 at Taneg, Mankayan, Benguet.

REVIEW OF LITERATURE

Importance of Organic Fertilizer

Organic farming is said to be original, main stream form of agriculture. Before the development of synthesized fertilizer and pesticide, practice of crop rotation and fertilization with animal manure and legumes were option available to most farmers to maintaining crop productivity (Barker, 2010).

Organic fertilizer, not only in providing plants nutrient but in helping to control soil borne disease, improve soil properties and maintain adequate soil moisture, has often been emphasized (Nishimune, 1993). In addition, Organic fertilizers are naturally occurring materials of biological or mineral origin and are low in nutrient concentration or solubility or have both properties. Organic fertilizer may be altered physically in processing for agricultural uses. The use of organic fertilizer, such as compost, is a method of recycling materials that might otherwise be wasted. Crops with low demand for nitrogen from the soil include those that are slow growing that have a very short growing season (Barker, 2010).

According to Deshmukh (2010), build up soil organic matter increased, bringing stability in soil ph and enhancement in organic carbon which is essential for good soil biological environment.

Effect of Climatic Factors on Growth and Seed Yield of Beans

Common bean grow well in humid and cooler climatic condition. High quality is obtained from seeds produced in cooler condition. It propagated by seed, which are sown directly in the fields in rows. Seed germinate better when the soil temperature is 30 degree Celsius

while temperature greater than 35 degree celsius is deleterious to germination. Soils rich in nutrient with good drainage are preferred for seed production (Cucci *et al*., 1994).

On physiological maturity, seed attain maximum weight and further in flow of dry matter ceases. Simultaneously, pod change color becoming yellow which is a useful sign in identifying seed maturity. Seed of early harvested pods (60 days from sowing) gave 25% germination and germination increased to 99% in seed extracted from fruits pods 75 to 93 days old (Koning, 1994).

Common beans are adapted to a wide range of environment in tropical, temperate and semi-arid condition throughout the world. Climate plays an important role in determining the growth and development of a crop. The growth of crop through its various development phases from germination to the crop maturity is guided by various environmental components. Soil and atmosphere environment are the most important. Under semi-arid condition several abiotic stress factor, such as drought, high temperature salinity affect crop growth and productivity (Maiti, 1997).

Varietal Evaluation

A varietal evaluation is a process in crop breeding which provides comparison of promising line with the local check on in order to establish the superiority of the lines developed by a breeder. It is only through varietal evaluation that a breeder sees/shows the better performance of the developed lines in terms of yield and quality, adaptability, resistance to pest and diseases stress (Regmi, 1990).

Varietal evaluation is an indispensable part in any crop breeding program as only through this evaluation that the performance of the variety is justified. Varietal evaluation gather data on plant characters, yield and pod quality. Varietal evaluation in National Variety

Testing Program is replicated and multi locational. This is done for 2 or more seasons before an entry can be recommended for commercial production as national or regional variety release (Tandang, 1990).

The importance of having a varietal evaluation is to observe performance character, such as yield, earliness in maturity, vigor and its resistant to pest and diseases, because different varieties have wide range of differences in plant size and yield performance (Work and Carew, 1995).

Chammah (1990) suggested that the choice of variety is important. The further observed that in many instances the wire use of improved variety has resulted in tremendous increases in yield.

Seed Production of Bush Bean

The diversity of the prevailing environmental condition in different region of the world affects bean production. Some factors which limit the production of beans are drought, insect and diseases (Van Schoonhoven et al.,1989).

To increased seed production it is necessary to adopt efficient agronomic practices such as seed preparation, tillage, fertilizer application, water management, soil temperature and harvesting methods (Maitii, 1997).

The production in the Philippines grows best in medium to high elevation areas temperatures of 18-29^{o}C. It can grown on the elevation areas during the cool, dry months but the yields tends to be lower. The usually planted of bush bean are during October and November to achieve higher percentage of pod set. It is suitable to clay loam soil, rich in organic matter with ph ranging from 5.5 to 7.5. the production on bush bean year 2005 was 12,049 tons while on year 2006 it increased to 13, 493 tons. The major producer in the

Philippines were the Cordillera Administrative Region (47%) and Cagayan Valley (28.5%) (PCARRD, 2006).

Effect of plant supplements
on growth and seed yield of beans

Like all living things, plants need a variety of nutrients to be at their best. Make sure your plants are getting the minerals and other specialty nutrients they require (Plant natural). These plant supplements are vitazyme, sagana 2000 and abundant harvest. Vitazyme can greatly enhance the plant ability to uptake nutrients giving them the boost they need to launch them into growth. It will enhance the plant value, all while improving soil structure and environment. One to three more treatments throughout the crop cycle can greatly enhance the plant ability to reach its genetic potential (Plant Lightning Hydroponics, 1990) In this non-replicated snap bean field study, Vitazyme applied at planting and again at prebloom boosted high yield. The plants were a bit taller and the beans a bit larger as well with Vitazyme use. Using a starter fertilizer along with Vitazyme would likely have led to an improved response in this moderately fertile soil (OMRI, 2005).

Sagana 2000 is a fortified organic-based liquid fertilizer extracted from various organic materials reduced to humus form and with both macro- and micro-elements. These components work together to provide a well-balanced supply of nutrients for a healthy, vigorous and productive plants,more resistant to the attack of pests and diseases. This is fast-acting for it provides direct supply of nutrient to the leaves, considered as the food factory of the plant and being organic-based it is highly biodegradable and environment friendly (Sagana 100 Phil.Inc., 2010).

MATERIALS AND METHOD

An area of 225 m^2 was properly cleaned and prepared. The area was been divided into three blocks consisting of fifteen plots each measuring 1m x 5m. The experiment was laid out using split plot design and was replicated three times.

Cultural management practices such as irrigation, weeding and hilling up were been uniformly employed to all treatments. Chicken dung was applied basally to the soil with a rate of 5kg per 5m^2 one week before planting. Two seeds were been sown per hill with a distance of 25cm x 25cm between hills and rows.

Main plot	Sub plot
F1-Vitazyme	V1- Hab 63
F2-Sagana 2000	V2-Sablan
F3-Abundant Harvest	V3-Contender
	V4-Bokod
	V5-Bush Blue Lake

The data gathered were the following:

1. Meteorological data. The temperature and relative humidity were taken by using a hygrometer. Rainfall was taken by placing plastic containers within the field to collect water when precipitation occurs. The volume of water collected was measured using a graduated cylinder. Rainfall was recorded by getting the average volume of water from the plastic container. Light intensity was taken by using a digital light meter.

2. Initial and Final Soil Analysis. Soil samples were taken from the experimental area before and right after harvest. The nitrogen, phosphorus, potassium, soil pH, and organic matter content of the soil were analyzed at the Department of Agriculture, Soil Laboratory, San Fernando.

3. Number of days from sowing to emerge. This was determined by counting the days from sowing to emergence.

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

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

6. Number of days from pod setting to seed maturity. This was taken by counting the number of days from pod setting to seed maturity (when pods turn to yellow).

7. Number of seed per pod. This was taken by counting the number of seed per pod from ten sample plants.

8. Initial and final height (cm). This was recorded by measuring ten sample plants. Initial plant height was recorded at two weeks after planting and final height was recorded just after full flower bloom.

9. Plant Vigor. This was recorded after 15 and 30 days after planting using the following scale:

SCALE	DESCRIPTION	REMARKS
1	Plants are weak with few stems and leaves; very pale	Poor Vigor
2	Plants are weak with few stems and leaves; pale	less vigorous
3	Better than vigorous	Vigorous
4	Plants are moderately strong with robust stem and leaves; leaves light green in color	Moderate vigorous
5	Plants are strong with robust stem and leaves; leaves are light to dark green color	Highly vigorous

10. Pest and diseases incidence. This was determined using the scale on bean rust and pod borer (Tandang et al., 2008).

a) Bean rust. The reaction to bean rust was record using the following scale:

SCALE	DESCRIPTION	REMARKS
1	No infestation per plot	Highly resistant
2	1%-25% of total plant/plot is infected	Mild resistant
3	26%-50% of total plant/plot is infected	Moderately resistant
4	51%-75% of total plant/plot is infected	Susceptible
5	76%-100%of total plant/plot is infected	Vey susceptible

b) Pod borer. This reaction of infestation of pod borer was obtained using the following scale:

SCALE	DESCRIPTION	REMARKS
1	No infestation per plot	Highly resistant
2	1-25% of total plant/plot is infected	Mild resistant
3	26-50% of total plant/plot is infected	Moderately resistant
4	51-75% of total plant/plot is infected	Susceptible
5	76-100% of total plant/plot is infected	Very susceptible

11. Total seed yield per plot(gm). Total seed yield per plot was recorded from each treatment and weighed.

12. Number of seed per pod. The number of seed (developed or undeveloped) was counted from ten random sample pods per treatment.

13. Weight of 200 seed (gm). Two hundred seeds per plot selected at random were weighed right after drying to determine the average seed weight.

14. Computed seed yield per hectare (kg/ha). This was determined using the formula:

$$\text{Computed Seed Yield} = \frac{\text{Total yield per plot}}{\text{Plot size (m)}} \times 2$$

15. Weight of marketable seed (g). This was determined by weighing the smooth, undamaged and seed free from pest and diseases.

14. Weight of non-marketable seed (g). This was obtained by getting the total number and weight of marketable and non marketable seed per plot.

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

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

Data Analysis

All quantitative data were analyzed using the analysis of variance (ANOVA) for Split plot Design with three replications in Randomized Complete Block Design (RCBD). The significance of difference among the treatment means was tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULT AND DISCUSSION

Meteorological data

Table 1 shows the temperature, relative humidity, light intensity and rainfall at Mankayan, Benguet from November 2012 to February 2013. The temperature ranged from 24^{o}C to 26^{o}C. The relative humidity ranged from 63% to 69%. The highest light intensity was noted in November (1156 lux) while the lowest was noted in the month of December 360 (lux). The rainfall amount ranged from 0 to 490 mL.

The meteorological data were not favorable for the production of bush bean. Bush bean grows best with temperature between 15 to 21^{o}C. It can also tolerate low temperature and can tolerate warm temperature up to 25^{o}C (HARRDEC, 2000).

Table 1. Meteorological data from November 2012 to February 2013

MONTH	TEMPERATURE (^{o}C)	RELATIVE HUMIDITY (%)	LIGHT INTENSITY (lux)	RAINFALL AMOUNT (mL)
November	26	63	1156	0
December	25	68	360	303
January	24	69	670	490
February	26	69	1109	0
MEAN	25	67	824	397

Soil Chemical Property

pH. From an initial pH of 6.7, soil pH decreased to 6.07,6.03 and 6.0. According to PCARDD (2006), bush bean are well suitable with pH ranging from 5.5 to 7.5.

Organic matter. Organic matter content in the soil increased to 1.2-1.5 % after harvesting.

Nitrogen. From an intial nitrogen of 0.05, an increased was observed to 0.075 and 0.06.

Phosphorous. Generally, an increase in soil phosphorous after harvesting the bush bean was observed.

Potassium. An increased in soil potassium was observed after harvesting the bush bean plants.

Table 2. Soil chemical property before planting and after harvesting

	pH	ORGANIC MATTER (%)	NITROGEN (%)	PHOSPHOROUS (ppm)	POTASSIUM (ppm)
Before planting	6.7	1.0	0.05	240	124
After harvesting					
Vitazyme	6.03	1.5	0.075	380	331
Sagana	6.07	1.5	0.075	310	262
Abundant harvest	6.0	1.2	0.06	327	228

Data analyzed at Soil Laboratory Department of Agriculture at San Fernando

Days from sowing to emergence

All the bush bean varieties applied with plant supplements uniformly emerged at six days after sowing .

Days from sowing to flowering and pod setting

Effect of plant supplements. No significant differences were observed on the number of days from sowing to flowering until pod setting of the five bush bean varieties applied with different plant supplements.

Effect of varieties. There were no significant differences observed on the number of days from sowing to flowering until pod setting of the different bush bean varieties to flower at 50 days and set pod at 53 days from sowing while Contendet, Bokod and Bush blue lake was the earliest flower to 49 days and set pod at 52 days from sowing.

Interaction effect. There was no significant interaction observed on the number of days from sowing to flowering until pod setting as affected by the varieties and the different plant supplements.

Plant vigor 30 DAP and 60 DAP

All the varieties evaluated were highly vigorous at 30 DAP, with strong and robust stems and leaves. At 60 DAP, All the plants were moderately vigorous strong and having robust stem and leaves with light green in color.

BLOCK 1

BLOCK 2

BLOCK 3

Figure 1. Plant vigor of bush bean varieties applied with plant supplements at 30 DAP

Table 3. Number of days from sowing to flowering and pod setting of bush bean varieties applied with plant supplements

TREATMENT	NUMBER OF DAYS FROM SOWING TO	
	FLOWERING	POD SETTING
Plant supplements (S)		
Vitazyme	49	52
Sagana	49	52
Abundant harvest	50	53
Variety (V)		
Hab 63	50	53
Sablan	50	53
Contender	49	52
Bokod	49	52
BBL 247	49	52
S x V	ns	ns
CV (a) %	1.80%	1.69%
CV (b) %	0.75%	0.71%

Means followed by common letters are not significant different ay 5% level of DMRT.

Initial and final plant height

Effect of plant supplements. Table 4 shows the plant height of bush beans applied with different plant supplements at 15 and 50 DAP. Taller plants were noted on bush bean varieties applied with Sagana having a height f 26.56 cm at 50 DAP

Effect of variety. The height of bush bean varieties at 15 and 50 DAP was highly significant. Hab 63 was the tallest at 15 DAP while Contender, Bush blue lake and Hab 63 were the tallest at 50 DAP. The difference in plat height may be attributed to varietal characteristics

Interaction effect. Statistically, there was no significant interaction between bush bean varieties and the different plant supplements on the plant height.

Table 4. Intial and final height of bush bean varieties applied with plant supplements

TREATMENT	PLANT HEIGHT (cm)	
	15 DAP	50 DAP
Plant supplements (S)		
Vitazyme	9.25	23.93
Sagana	9.65	26.56
Abundant harvest	9.53	24.45
Variety (V)		
Hab 63	10.12[a]	25.30[a]
Sablan	8.96[b]	22.75[b]
Contender	9.28[b]	26.02[a]
Bokod	9.68[b]	24.96[ab]
Bush blue lake	9.34[b]	25.53[a]
S x V	ns	ns
CV (a) %	5.41	12.81
CV (b) %	6,28	9.02

Means followed by common letters are not significant different at 5% level of DMRT.

Number of flower per cluster,
pod per cluster and seed per pod

The five bush bean varieties applied with different plant supplements produced 5 flower per cluster, 4 pods per cluster and 6 seeds per pod.

Reaction to Bean Rust and Pod Borer

The bush bean varieties applied with plant supplements showed moderately resistance to bean rust and pod borer which means 26- 50% of the total plants were infected. Resistance to pest plays an important role in bush bean production because infection could affect the photosynthetic activity of the plant (Tandang, 1990).

Weight of 200 seeds

Effect of plant supplements. No significant differences on weight of 200 seeds harvested from the different bush bean varieties applied with plant supplements were observed. The two hundred seed weight of the plant ranged from 95.47 to 95.40 grams.

Effect of variety. There was no significant difference observed on the weight of 200-seeds weight of the bush bean varieties applied with plant supplements. Contender had the highest 200-seed weight of 101.89 g.

Interaction effect .There was a highly significant interaction observed on the weight of 200 seeds from bush bean varieties applied with plant supplements applied with abundant harvest had heaviest weight of 200 seeds (Figure 1).

Table 5. Weight of 200 seeds of bush bean varieties applied with plant supplements

TREATMENTS	WEIGHT OF 200 SEED (g)
Plant supplemtns (S)	
Vitazyme	95.40
Sagana	95.00
Abundant harvest	95.47
Variety(V)	
Hab 63	91.89
Sablan	93.89
Contender	101.89
Bokod	94.78
Bush blue lake	94.00
S x V	**
CV a%	0.73
CV B %	2.10

Means followed by common letters are not significant different at 5% level of DMRT.

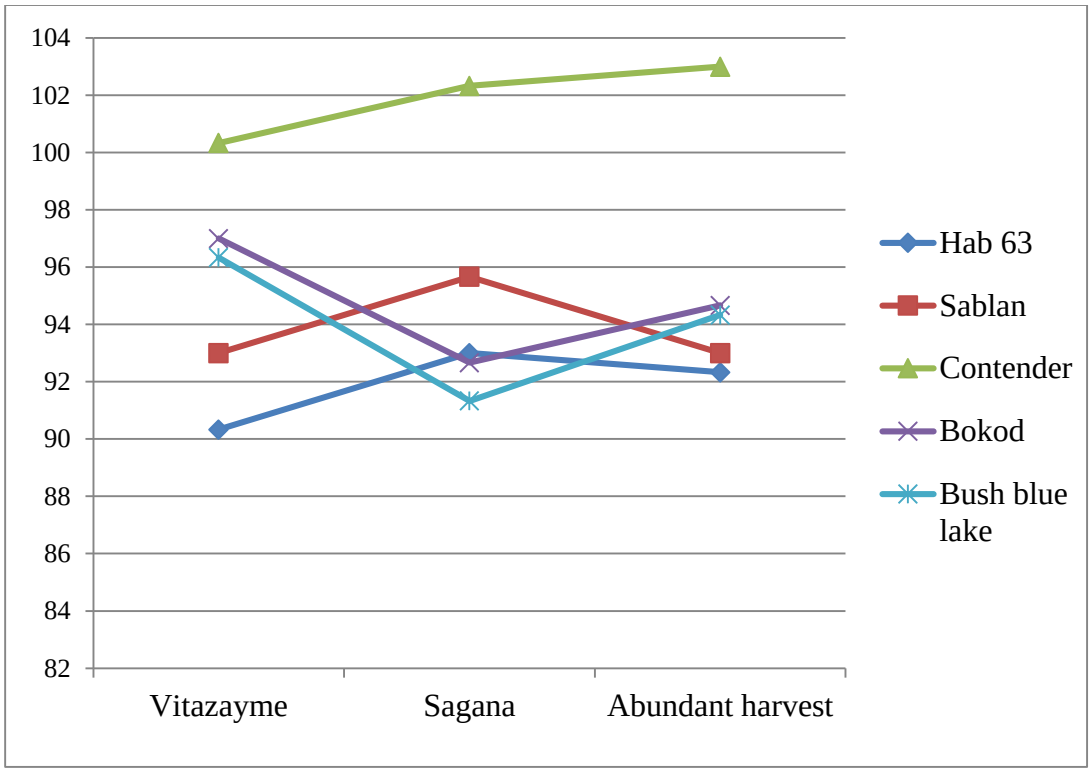

Figure 2. Interaction between bush bean varieties and plant supplements on 200-seed Weight

Weight of marketable and non-marketable seed

Effect of plant supplements. No significant differences were observed on the weight of marketable and non marketable seed. Bush bean applied with vitazyme had the highest weight of marketable seeds.

Effect of varieties. Highly significant differences were observed on the weight of marketable seeds of plant applied with different plant supplements. Contender (510 g) had the highest weight of marketable seeds followed by Bush blue lake (450 g), Hab 63 (420 g), and Bokod (410 kg) while the lowest was obtained from Sablan. Non-marketable seed weight ranges from 13-19 g.

Interaction effect. No significant interaction was observed between the plant supplements and bush bean varieties in terms of weight of marketable and non-marketable seed.

Total and Computed yield

Effect of plant supplements. No significant differences were observed on total and computed yield of bush bean varieties applied with plant supplements. It was observed that plants applied with vitazyme had the highest total and computed yield.

Effect of varieties. Highly significant differences were observed on the total and computed yield of the bush bean varieties. Contender produced the highest total yield.

Interaction effect. No significant interaction was noted in terms of total and computed of bush bean varieties applied with different plant supplements.

Table 6. Total yield and computed yield of bush bean varieties applied with plant supplements

TREATMENTS	TOTAL YIELD (g)	COMPUTED YIELD (kg/ ha)
Plant Supplements (S)		
Vitazyme	455	0.91
Sagana	428	0.87
Abundant harvest	447	0.95
Variety (V)		
Hab 63	431[b]	0.87[b]
Sablan	360[b]	0.71[c]
Contender	530[a]	1.06[a]
Bokod	400[b]	0.86[b]
Bush blue lake	430[b]	0.86[b]
S x V	ns	ns
CV a %	12.59	12.06
CV b %	9.98	9.95

Means followed by common letters are not significant different at 5% level of DMRT.

Table 7. Return on cash expenses of bush bean varieties applied with plant supplements

TREATMENT	YIELD (kg/5m^2)	GROSS INCOME	COST OF PRODUCTION (PhP)	NET INCOME (PhP)	ROCE (%)
Vitazyme					
Hab 63	1.26	378.00	275.00	103.00	37.45
Sablan	1.07	321.00	275.00	46.00	16.72
Contender	1.59	477.00	275.00	202.00	73.45
Bokod	1.22	366.00	275.00	91.00	33.1
BBL 247	1.21	363.00	275.00	88.00	32
Mean	1.27	381.00	275.00	106.00	38.54
Sagana					
Hab 63	1.27	381.00	297.50	83.50	28.07
Sablan	1.03	309.00	297.50	11.50	3.87
Contender	1.61	483.00	297.50	185.50	62.35
Bokod	1.31	393.00	297.50	95.50	32.10
BBL 247	1.36	408.00	297.50	110.50	37.14
Mean	1.32	396.00	297.50	98.50	33.11
Abundant harvest					
Hab 63	1.38	414.00	337.50	76.50	22.67
Sablan	1.1	330.00	337.50	-7.50	-0.02
Contender	1.57	471.00	337.50	133.50	39.56
Bokod	1.34	402.00	337.50	64.50	19.11
BBL 247	1.29	387.00	337.50	49.50	14.67
Mean	1.34	402.00	337.50	64.50	19.41

*Bush bean seeds were sold at Php 300/kg
*Cost of production includes land preparation, plant supplements, seeds and labor

Return on cash expense

Table 7 shows the return on cash expense (ROCE) of the bush bean varieties applied with plant supplements. Contender applied Vitazyme also gave the highest ROCE of 73.5 %. A negative ROCE result from Sablan applied with Abundant harvest.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Seed yield of bush bean varieties applied with plant supplements was conducted at Taneg, Mankayan, Benguet from November 2012 to February 2013. The objectives of the study were to determine the best seed yielding bush bean varieties under Taneg, Mankayan, Benguet; determine the best plant supplements for bush bean seed productions; compare the growth and seed yield of bush bean varieties applied with plant supplements; and determine the profitability of seed production of bush bean varieties applied with plant supplement in Taneg Mankayan Benguet.

Among the bush bean varieties, significant difference were observed on plant height, marketable seed weight, total yield and computed yield. Contender produced the highest yield and ROCE.

In terms of plant supplement application, no significant difference were observed on all parameters gathered.

A significant interaction between bush bean varieties and plant supplements were observed on weight of 200-seeds. Contender applied with Abundant harvest produced the highest 200-seed weight.

Contender applied with Vitazyme had the highest ROCE of 73.45%

Conclusion

Based on findings, Contender was the best performer total and computed yield and ROCE.

Application of Vitazyme to the bush bean plants produced higher seed yield and profit.

The combination of contender and vitazym produced the highest yield and ROCE.

Recommendation

Contender is recommended for bush bean seed production under Taneg, Mankayan, Benguet condition while Vitazyme could be applied as a plant supplements.

LITERATURE CITED

ACOSTA,G.J and W.G. MARRERO. 2007. Vitazyme on Dry Beans. Retrieved on January 7, 2013 from http://agbionic.com/PDFCropreports/DryBeans1995-200-2007.pdf.

AG BIOTECH. 2010.Vitazyme an all natural biostimulant concentate. Retrieved on february 10, 2013 from http://agbioinc.com/english/

BARKER, A. V. 2010.Science and Technology of Organic farming . London New York. CRC Press. Pp 7-13.

DESHMUKH, S.N. 2010. Organic Farming Principles, Prospect and Problem. New Delhi, Agrohos India. P.17.

CHAMMA, H., F. MARCOS ., and C.ROCOMO. 1990. Maturation of Seed of Aroano bean and its influence on the storage potential seed science technology.18-371-382

CUCCI, G.,A. D. CARO, L. CICIRETTI, and B. LEONI.1994. Salinity and Seed Germination of some vegetables crops.Acta Hort. no.362:305-309

DOIJODE, S. N. 2001. Seed Storage of Horticultural crops. New York. London. Oxford. Howarthon Press. Inc. Pp. 235-240.

KONING,R. E.1994. Morphology and anatomy. Retrieved on July 29,2012 from http://plantphys.info/plants_human/morpanat.shtml.

MAITII ,R.K. 1997. Bean Science. Puelo, Mexico: Science Publishers Inc. Pp.1-2, 15-16, 23.

NISHIMUNE, A. 1993. Food and Fertilizer Technology Center, Combination of Organic and In organic Fertilizer for Crop Production. ASPAC.Japan. Upland Agriculture Research Center. P1.

OMRI. 2005.Vitazyme on All Natural Biostimulant Concentrate. Retreived on January 7, 2013 from http://www.plantdesigns.com/vitazyme/field_studies/show/2003-north-america17.

PANGO-OT. 2010. Standard procedure and guidelines from national cooperative(NCT). National Seed Industry Council.Department of Agriculture.Bureau of Plant Industry. P.29.

PHILIIPINE COUNCIL FOR AGRICULTURE, FORESTRY AND NATURAL RESOURCES RESEARCH AND DEVELOPMENT (PCARRD). 2006. Organic Fertilizer and Utilization. Los Banos, Laguna: PCARRD. P. 132.

PLANT LIGHTNING HYDROPONICS. 1990. Plant Supplement and Method for Increasing Plant Productivity and Quality. Retreived on August 1, 2012 from http://www. plantlightninghydroponics.com/index.php.

REGMI, S.K. 1990. Varietal Evaluation of Promising Lines and Path Coefficient Analysis in Pole Snapbean(*Phaseolous vulgaris* I.). MS Thesis. Benguet State University.

SAGANA 100 PHILIPPINE INCORPORATION. 2010. Sagana 100 Philippine Incorporation, A Vision of A World in Perfect Abundance. Retrieved on January 7, 2013 from http://sagana100phils.com/our-products.html.

TANDANG, L. A.1990. Promising Varieties of Snap Bean in the Highlands. Paper Presented at Regional Symposium on Research and Development Highland.RSDC, BSU. L ATRINIDAD BENGUET. P. 17-18

VAN SCHOONHOVEN, A. and O. VOYSESTS. 1991. Common bean: Research for Crop Improvement.Wallinlingfork,UK:CAB International.

WORK, D. and J. CAREW. 1995. Poducing vegetables crop. The Interstate Printers and Publisher, Inc. printed in the United State of America. P. 238.