BIBLIOGRAPHY

OSSOG, LESTER F. APRIL 2010. Evaluation of Garden pea Accessions applied with Effective Microorganisms ($EM_{1)}$ in La Trinidad, Benguet. Benguet State University, La Trinidad Benguet.

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ABSTRACT

The study was conducted to determine the effect of EM_1 on the growth and yield of garden pea accessions, the growth and pod yield of the promising garden pea accessions under organic production, the interaction of garden pea accessions and EM_1 application, and the profitability of growing different garden pea accessions applied with EM_1.

The garden pea accessions significantly differed with each other in terms of height, number of days from emergence to flowering, number of pods per plant, pod length and width and pod yield. Accession CGP 116 produced the tallest plants and highest pod yield resulting to higher ROCE.

Application of EM_1 significantly affected pod width and weight of marketable pods of the different accessions.

EM_1 application and the garden pea accession had significant interaction effect on the number of days from flowering to pod setting, pod length and width of the garden pea accessions.

Plants untreated with EM_1 and accession CGP 116 obtained the highest fresh pod yield and ROCE.

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INTRODUCTION

In the Philippines particularly in Benguet, garden pea (*Pisum sativum*) is one of the top money making crop cultivated. Demand for this crop is great due to its food value, industrial and agricultural needs and importance. Green pods are prepared as vegetable food; the seeds are processed into canned products, while the byproducts and vines are used as animal feed (Swiader and Ware, 2002).

At present, garden pea production is still short of demand due to many reasons. First, there are few farmers engaging in garden pea production because of high production costs, resulting to very low profit. This is attributed by the rapid multiplication of major insect pests and diseases of the crop and the continuous increase in the prices of commercial fertilizers and chemicals used to control these problems that ordinary farmers can hardly afford.

Thus, finding an alternative way to reduce cost of inputs in garden pea production and bringing back to life the sick soil must be done. Organic farming promotes the use of natural inputs and effective cropping and farming system to reduce the production inputs. The practice is less costly and is environment friendly.

One practice in organic farming is the use of resistant varieties against diseases and insects. The garden pea accession which was used in this study were evaluated through the conventional way of farming. A need to evaluate these garden pea accessions under organic production is also important. On the other hand, a means of sustaining the soil nutrients has been developed and found significant. This is the use of effective microorganisms (EM_1) which when present in the soil can give numerous benefits to crops. These microorganisms work harmoniously with beneficial microorganisms to

produce enzymes, bioactive substances, and vitamins that support plant growth directly or indirectly. One typical example is the Vesicular-arbuscular mycorrhiza, which can supply phosphate to plants and will breed and co-exist with azotobacter. Garden pea can host this effective microorganism thereby increasing their population in the soil and in return improving growth and yield performance of the plant.

The result of the study if successful and found significant will be introduced to farmers to help them lessen their production input and make garden pea production more sustainable.

The study was conducted to:

1. determine the growth and pod yield of the promising garden pea accessions at La Trinidad, Benguet;

2. determine the effect of EM_1 on the growth and yield of the garden pea accessions;

3. determine the interaction of the garden pea accessions and EM_1 application; and

4. determine the profitability of growing the different garden pea accessions applied with EM_1.

The study was conducted at BSU Organic farm, from November 2008 to February 2009.

REVIEW OF LITERATURE

Importance of Variety Evaluation for Organic Farming

Varietal evaluation is a process in Plant Breeding which provides a comparison of promising lines developed by breeders. It is through varietal evaluation that a breeder selects the best performing variety among the developed lines in terms of yield, quality, adaptability, stress, tolerance and resistance to pest and diseases (Sunil, 1990).

Bautista and Mabesa (1997) cited that selecting the right variety would minimize problem associated with water and fertilizer management. Varieties should be high yielding, pest and disease resistant and early maturing so that production would entail less expense and ensure more profit.

HARRDEC (1996) further cited that varietal evaluation is important in order to observe performance character such as yield, earliness, vigor, maturity and keeping quality because different varieties have wide range of differences in plant size and in yield performance. However the varieties to be selected should be high yielding, insect and disease resistant and early maturing. There is variation in the yielding ability of the different varieties when grown under the same method of culture. A variety that yields well in one region is not a guarantee that it will perform well in another region, in addition, choosing variety that is most suited to the prevailing climatic condition.

Definition and Importance of organic farming

Briones (1997) defined organic farming as whole system approach that works to optimize the natural fertility resources of the farm. This is done through traditional

practices of recycling farm-produced livestock manures, composting, crop rotation, and green manuring and crop residue management.

"Organic farming like all various forms of sustainable agriculture such as organic agriculture, biodynamic agriculture and natural way of farming share a concern for the health and welfare of the farmer in the future. A way of farming that avoids the use of synthetic fertilizers as well as genetically modified organisms (GMO's), and usually subscribe the principles of sustainable agriculture. Organic farming management relies on developing biological diversity in the field to disrupt habitat for pest's organisms, and replenishment of soil fertility. While they have different practices they are guided with the seven principles of sustainable agriculture; ecologically sound, economic viability, socially just, cultural sensitivity, appropriate technology, holistic science, and human development".

NPRCRTC (1998), stated that organic farming methods are practical ways to increase yield, conserve the soil, and maintain the water quantity and lower operating costs. Organic farms produce the same amount yield of the same quality for the same costs as conventional farms of the same size. Moreover, organic farm are relatively free from the possible toxicities to soil and to flora and fauna in general.

In addition (Keupper, 2002), claimed that crop rotation, cover cropping, green manuring, use of livestock manure and composting are all soil building practices that do much more than provide Nitrogen, By adding organic matter and stimulating biological activity in the soil, these practices make mineral nutrients more available to plants, generate the microbial production of plant beneficial chemicals and improve soil tilth.

Spreading livestock manure in particular cycles essential macro and micro nutrients back onto the field.

Anonymous (2005), further reported that, according to the research of the team led by Pad Madera organic farms can nearly as productive as regular farms for some crops, and they leave soils healthier. Organic soil management improves soil structure by increasing soil activity, thus reducing the risk of soil erosion. In addition to advantages in soil fertility management, organic farming enhances biodiversity. Organic management results in farms hosting more kinds of beneficial insects.

EM_1 Defined

"EM_1 are live microorganisms which when administered in adequate amounts confer a health benefit on the host". This definition has the following characteristics; probiotic must be alive, must be delivered a measured Physiological benefit.

Use of EM_1

While soils are populated by many organisms such as animals and microorganisms, it is generally considered that microorganism play an important roles in soil. The recycling of key nutrients and for degrading organic matter and even the Oxygen us breath is the result of microbial activity (FAO-WHO, 2001).

One of the promising products of biotechnology is the effective microorganisms (EM_1) technology developed by Professor Teruo Higa in 1994, University of the Ryukus, Okinawa Japan. Effective microorganisms consist of mixed cultures of beneficial and naturally occurring microorganisms that can be applied as inoculants to increase the microbial diversity of soils and plants. Research has shown that the inoculation of EM_1

cultures to the soil, plant ecosystem improve soil quality, soil health and the growth, yield and quality of crops. Effective microorganisms contain selected species of microorganisms including predominant population of lactic bacteria, yeast and smaller numbers of photosynthetic bacteria/ actinomycetes and other types of microorganisms. All of these are mutually compatible with one another and can co- exist in liquid culture. Effective microorganisms is no substitute for other management practices as crop rotations, use of organic amendments, conservation tillage, crop residue recycling and biocontrol pests. If used properly, effective microorganisms can significantly enhance the beneficial effects of these practices (Higa and Parr, 1994).

Crop protection in Organic Farming

Pest control in organic farming involves a lot of strategy, these includes the various cropping systems such as crop rotation, multiple cropping, mixed cropping and diversification. The used of pesticide is strictly prohibited. An organic farmer relies on the diverse population of beneficial insects that helps in maintaining the pest population. Organic growers also employ natural control on insects through the technique which is known as Integrated Pest control (IPM). It involves handpicking, use of repellants and the use of Organic pesticides or botanical extracts (Pawar, 2005).

Soybeans, according to Keupper (2002), organic soybeans are best grown in rotation with other several crops that ideally compensate for one another. Organic production is further enhanced when livestock enterprises that involve grazing and generate manure are also part of the system. It was found that a good crop rotation with proper fertility management appears to suppress most soybean pest problems in organic

production. Rotating to non-host crops and integrating nematicidal crops into the crop mix have proved effective to control nematodes.

Rice, according to Sullivan (2003), leguminous green manure crops can supply 30 to 50 percent of Nitrogen needs of high yielding rice varieties depending on the quality, quantity and type of green manure crop.

Corn, according to Diver et al. (2001), the production of the sweet corn was improved when the field was intercropped with white clover as living mulch. White clover was mutilated or not tilled with the middle fines removed, leaving strips of clover growing between the corn rows.

According to Dela Cruz (2004), crops that were applied with animal manure performed better compared to those crops that were grown with commercial organic fertilizer. The slow released of nutrients of the animal manure minimizes the nutrient losses in the soil resulting the efficient uptake.

Bacod (2007) evaluated the effect of probiotics on the growth and yield of different potato accessions under organic production. He revealed as for economic analysis, plants not applied with probiotics obtained higher return on cash expense (ROCE). So he concluded that potatoes can be grown organically either with or without application of probiotics.

MATERIALS AND METHODS

An area of 120 m^2 was thoroughly prepared and divided into three blocks representing the three replications. Each block contained 10 plots measuring 1m x 5m. The plots were applied with mushroom compost as basal fertilizer at the rate of 5kg/5m^2 plot. The compost was mixed thoroughly with the soil.

Planting was done one week after application with three seeds sown per hill at a distance of 20 cm between rows and 15 cm between hills. Soil samples were taken before the application of mushroom compost and after harvesting for soil analysis. Sunflower compost juice was applied uniformly three weeks after emergence and two weeks before flowering.

All necessary practices employed in garden pea production were properly implemented from planting until harvest.

EM_1 was mixed with water and applied to the plots uniformly through spraying. It was applied three times before planting, two weeks after emergence and before flowering.

The experiment was laid out following split-plot design with three replications. EM_1 treatment was assigned as the main plot and the five accessions of garden pea as subplots.

The treatments were as follows:

Main Plot

with EM_1 - applied with EM_1

without EM_1- no application of EM_1

Sub Plot	(Garden Pea Accession)	Source
1	CLG	BSU-IPB-HCRS
2	CGP 11O	BSU-IPB-HCRS
3	CGP 116	BSU-IPB-HCRS
4	CGP 34	BSU-IPB-HCRS
5	CGP 18-A	BSU-IPB-HCRS

Data Gathered

1. Maturity

a. Number of days from sowing to emergence. This was taken when 80% of the seeds have emerged.

b. Number of days from emergence to first flowering. This was recorded by counting the number of days from the emergence to the time when 50% of the plants in the plot had at least two fully opened flowers.

c. Number of days from flowering to pod setting. This was taken by counting the number of days from flowering until the pods were fully developed.

2. Growth Parameter

a. Height at maturity. This was recorded by measuring the height of ten sample plants taken at random per treatment during the last harvest.

b. Pod length. This was taken by measuring the length of the ten sample pods taken per treatment.

c. Pod width. This was taken by measuring the width of the ten sample pods taken per treatment.

3. Yield and Yield Components

a. Total marketable pods (kg/plot). This was the total weight of marketable pods harvested at the end of cropping season.

b. Total non-marketable pods (kg/plot). This was the total weight of harvested non- marketable pods which included those that are deformed and diseased damage.

c. Total yield (kg/15m^2).This was the total weight of harvested pods per plot.

d. Number of harvest. This was taken by recording the number of harvest from the first up to the last harvest.

e. Total number of harvested pods. This was taken by recording the number of pods produced from the ten sample plants per treatment at the end of the cropping season.

f. Computed yield (t/ha). This was the total yield per hectare based on the yield per plot. It was computed using the formula:

Computed yield = yield (Kg/ plot) x 10,000

4. Pest and disease occurrence

a. Pest Infestation (leaf miner and pod borers). This was determined by using the following scale (Teng1987):

Scale	Description	Remarks
1	No Damage	Highly resistant
2	1-25% infestation	Mildly resistant

3	26-50% infestation	Moderately resistant
4	51-75% infestation	Moderately susceptible
5	76-100% infestation	Very susceptible

b. Disease infection (powdery mildew). This was determined by using the following scale (Buena, 2004):

Scale	Description	Remarks
1	No Damage	Highly resistant
2	1-25% infestation	Mildly resistant
3	26-50% infestation	Moderately resistant
4	51-75% infestation	Moderately susceptible
5	76-100% infestation	Very susceptible

5. Other data

a. Return on cash expenses. This was computed using the formula:

$$\text{ROCE} = \frac{\text{Gross Income} - \text{Production Cost}}{\text{Production Cost}} \times 100$$

Data Analysis

All quantitative data was subjected to the analysis of variance using the split plot design with three replications. Significance of difference among treatments was tested using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Soil Analysis Before Planting and After Harvest

Table 1 presents the pH and nutrient content of the soil before and after planting. The pH of the soil increased to nearly neutral pH and the organic matter content of the soil also increased. There was a remarkable increase on the phosphorus and potassium contents of the soil after the conduct of the study.

This noted increase in soil pH, percent OM, phosphorus and potassium after harvest may be due to the application of mushroom compost, sunflower compost juice and EM1. This noted improvement on the soil was favorable to the crop, since the pH requirement of the plant is in between 6-7. It also helped in suppressing soil borne diseases that usually thrives in low pH soils.

Agro-climatic Data

Table 2 shows the temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study. Temperature ranged from 13.4˚C to 25.2˚C. Mean relative humidity was 55.69% while rainfall amount recorded was 2.88 mm. Total sunshine ranged from 304.6 to 3.87 Kj.

Table 1. Soil pH, Organic Matter, Phosphorus, and Potassium before planting and after harvest

	pH	OM %	P (ppm)	K(ppm)
Before planting	6.5	0.63	109	215
After harvest				
With EM_1	6.9	0.82	300	308
Without EM_1	6.9	0.76	164	300

Garden pea is a temperate crop which grows best in areas with 10˚C-25˚C and with good relative humidity throughout the season. Highest percentage of seed emergence can be expected in October planting when sufficient moisture favors germination. This planting period produces more yield and attractive pods due to the relatively lower temperature that prevails during the growing and flowering stage (Dayag, 1980).

Table 2. Temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study

MONTHS	TEMPERATURE ˚C		RELATIVE HUMIDITY (%)	RAINFALL AMOUNT (mm)	SUNSHINE DURATION (Kj)
	MAX	MIN			
November	25.2	16.20	75.20	3.10	304.60
December	24.4	13.60	82.00	0.10	369.80
January	24.6	13.40	85.00	0.03	349.00
February	24.5	14.05	85.25	3.45	387.20
Mean	24.7	15.67	55.69	2.88	364.04

Table 3. Number of days from sowing to emergence, from emergence to first flowering and from flowering to pod setting of garden pea accessions applied with EM_1

TREATMENT	NUMBER OF DAYS FROM		
	SOWING TO EMERGENCE	EMERGENCE TO FIRST FLOWERING	FLOWERING TO POD SETTING
EM_1 TREATMENT (PT)			
with EM_1	8	48	8
without EM_1	8	49	8
GARDEN PEA ACCCESIONS (GPA)			
CLG	8^{a}	50^{cb}	7^{a}
CLG 110	7^{a}	49^{ab}	9^{b}
CGP 116	8^{a}	52^{c}	9^{b}
CGP 34	10^{b}	51^{bc}	9^{b}
CGP 18-A	7^{a}	40^{a}	8^{ab}
PT x GPA	ns	ns	*
CV a (%)	8.98	1.06	11.28
CV b (%)	5.02	1.61	9.40

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

Days to Emergence

Effect of EM_1. Application and no application of EM_1 treatment did not show a significant effect on the number of days from sowing to emergence. Untreated and treated plants emerged eight days after sowing (Table 3).

Effect of accessions. CGP 110 and CGP 18-A were the first to emerge at 7 days after sowing, followed by CLG and CGP116 while CGP 34 was the last to emerge. This was probably due to the condition when the seeds were sown; it rained heavily afterward compacting the soil and covered the seeds with thick soil.

Interaction effect. EM_1 treatment and the garden pea accessions had no significant interaction on the number of days from sowing to emergence.

Days from Emergence to First Flowering

Effect of EM_1. There was no significant difference observed on the plants untreated and treated with EM_1 on the number of days from emergence to first flowering (Table 3).

Effect of accession. There were slight differences recorded on the number of days from emergence to first flowering of the garden pea accessions. CGP 18-A was the earliest to flower (40 DAE) while CGP 116 was the latest to bear flowers (52 DAE). This is because each accession exhibit different genetic characteristics, those which flower earlier is a descendant from Chinese garden pea which has early maturity (Benguet Technoguide for Gardenpea, 1985).

Interaction effect. There was no significant interaction among the treatments observed.

Number of Days from Flowering to Pod setting

Effect of EM_1. As shown in Table 3, application and non-application of EM_1 on the garden pea accessions had no significant effect on pod setting. Both treatments developed pods eight days after flowering.

Effect of accession. There were significant differences observed on pod setting of the garden pea accessions tested. CLG was the earliest to form pods, followed by CGP 18-A and CGP 110, CGP 116 and CGP 34 were the latest to flower. These differences were also due to their different genetic make-up. This also corroborates with the result of

the evaluation conducted by Gawidan in 2006, which revealed that CLG and CGP 18-A set pod earlier than the other entries evaluated.

Interaction effect. Statistics shows that there was a significant interaction between application of EM_1 and the accessions (Fig.1). The plants (e.g. CLG) applied with EM_1 set pod one day earlier than those plants not applied with EM_1. This has something to do with the introduction of additional beneficial microorganisms to the soil which may have enhanced the availability of nutrients present in the soil for easier absorption by the plants.

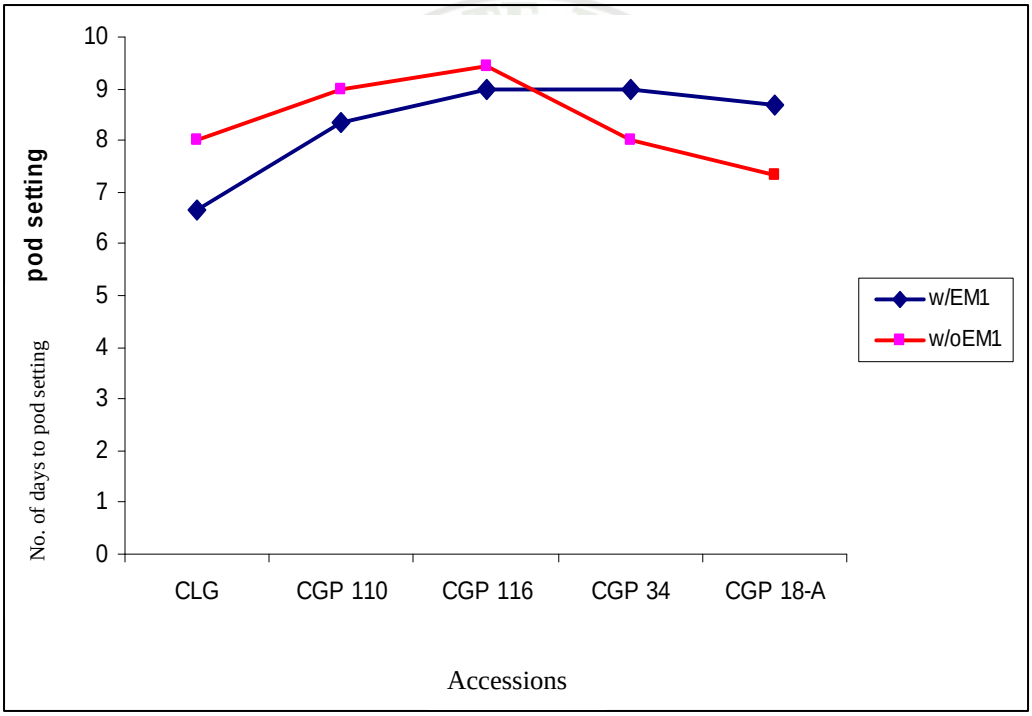

Figure 1. Interaction effect of EM_1 application and garden pea accessions on the number of days from flowering to pod setting

Height of Garden Pea

Effect of EM_1. Table 4 shows the height of the plant at maturity. There were no significant differences observed as an effect of application and non-application of EM_1 on the height of garden pea at 100 DAP.

Effect of accessions. There was a highly significant difference among the garden pea accessions observed. Accession CGP 116 was the tallest (131.167cm) followed by CLG and CGP 34. Accession CGP 18-A and CGP 110 were the shortest. This results corroborates with the evaluation conducted by Lynette Gawidan (2006) wherein CGP 18-A was the shortest among the ten accessions evaluated.

Interaction effect. There was no significant interaction observed between the application of EM_1 and accessions on plant height.

Number of Harvest

Effect EM_1. There were no significant differences observed on the application and non-application of EM_1 on the garden pea accessions. Remarkably higher number of harvest is recorded on the plants applied with EM_1. This may be because the plants applied with EM_1 were slightly taller than the untreated ones (Table 5).

Effect of accession. Table 5 shows that the accessions were significantly different in terms of the number of harvest. Accession CGP 116, CGP 34 and CLG recorded the highest number of harvest (6x). Accession CGP 110 and CGP 18-A had the least number of harvests. This was due to the severe occurrence of powdery mildew on CGP 18-A and CGP 110 which may have suppressed further flowering.

Interaction effect. There were no significant interaction noted between the application of EM_1 and the accession on the number of harvest.

Table 4. Plant height of garden pea accessions applied with EM_1 at 100 DAP

TREATMENT	PLANT HEIGHT (cm)
EM_1 TREATMENT (PT)	
with EM_1	124.73
without EM_1	113.13
GARDEN PEA ACCESSIONS (GPA)	
CLG	121.17[b]
CGP 110	105.50[c]
CGP 116	131.17[a]
CGP 34	126.50[ab]
CGP 18-A	110.33[c]
PT x GPA	ns
CV a(%)	6.45
CV b(%)	1.78

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

Number of Pods per Plant

Effects of EM_1. There was no significant difference noted on the number of pods produced per plant as an effect of application and non-application of EM_1 (Table 5).

Effect of accession. Significant difference was noted among the five garden pea accessions in the total number of pods produced per plant (Table 5). Accession CGP 116 and CLG obtained the highest number of pods per plant while CGP 18-A and CGP 110 registered the lowest pods produced per plant. It was observed that accession CGP 116 and CGP 34 had two flowers per cluster but are now significantly different on the number of pods per plant.

Interaction effect. No significant interaction between the application of EM_1 and the different garden pea accession was noted on the number of pods per plant.

Table 5. Number of harvest and total number of pods per plant of garden pea accessions applied with EM_1

TREATMENT	NUMBER OF HARVEST	NUMBER OF PODS PER PLANT
EM_1 TREATMENT (PT)		
with EM_1	6	23
without EM_1	5	21
GARDEN PEA ACCESSION (GPA)		
CLG	6^a	26^a
CGP110	5^b	17^c
CGP116	6^a	27^a
CGP34	6^a	24^b
CGP18-A	5^b	16^c
PT x GPA	ns	ns
CV a (%)	6.06	6.06
CV b (%)	13.61	13.61

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

Pod Length

Effect of EM_1. Table 6 shows that no significant difference was noted on the pod length as affected by application and non-application of an effect of EM_1.

Effect of accession. There was a highly significant difference noted among the accessions in their pod length. CGP 18-A had the longest pod while CLG registered the shortest pod (Table 6).

Interaction effect. A highly significant interaction effect was noted on the application of EM_1 and garden pea accessions (Fig.2). Longer pods were produced by accessions CGP 18-A, CGP 34 and CGP 110 as affected by EM_1 application. This can be

attributed to the microorganisms present in EM_1, particularly their ability to enhance photosynthetic capacity of the crops.

Table 6. Pod length and width of garden pea accessions applied with EM_1

TREATMENT	POD	
	LENGTH (cm)	WIDTH (cm)
EM_1 TREATMENT (PT)		
with EM_1	7.68	1.41^{a}
without EM_1	7.54	1.36^{b}
GARDEN PEA ACCESSION (GPA)		
CLG	7.11^{d}	1.36^{b}
CGP110	7.33^{cd}	1.35^{b}
CGP116	7.61^{bc}	1.54^{a}
CGP34	7.81^{b}	1.29^{c}
CGP18-A	8.19^{a}	1.39^{b}
PT x GPA	**	**
CV a (%)	2.31	2.27
CV b (%)	2.32	0.87

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

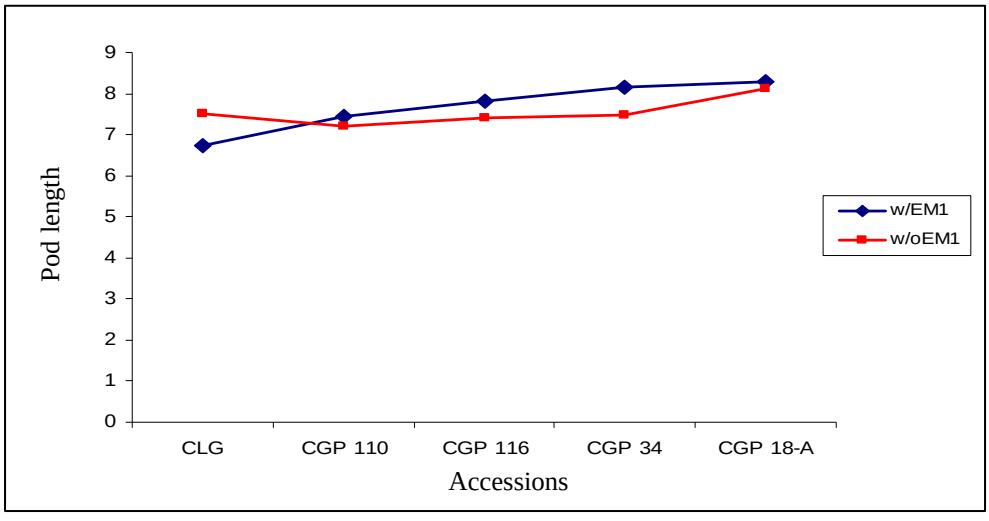

Figure 2. Interaction of EM_1 application and garden pea accessions on the length of pods

Pod Width

Effect of EM_1. There was a significant difference noted on the width of the pods as an effect of the application and non- application of EM_1 (Table 6). The pods produced by the plants applied with EM_1 exhibited wider pods in comparison with the pods produced by the plants not applied with EM_1. This difference may be attributed to the microorganisms introduced to the soil. The plants applied with EM_1 were also significantly taller and more vigorous than the plants not applied with EM_1.

Effect of accession. Table 6 shows that a highly significant difference was shown on the pod width of the garden pea accessions. Accession CGP 116 had the widest pods while the narrowest pods were measured on accession CGP 34.

Interaction effect. A highly significant interaction on the application of EM_1 and garden pea accessions was noted (Fig.3). An increase on pod width was observed on accessions CLG, CGP 116 and CGP 18-A as an effect of the application of EM_1. These findings imply that accessions CLG, CGP 116 and CGP 18-A applied with EM_1 may result in wider pods.

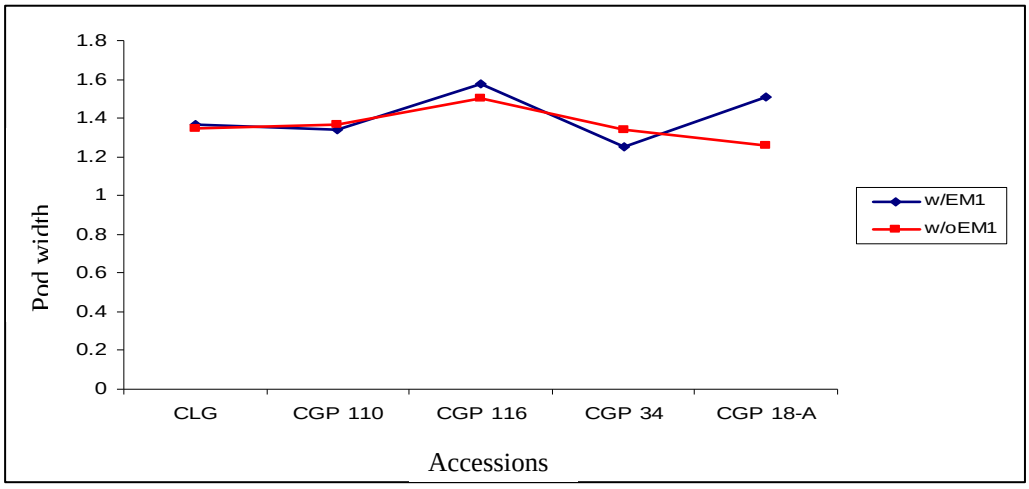

Figure 3. Interaction of EM_1 application and garden pea accessions on the width of pods

Reaction to Powdery Mildew

Effect of EM_1. Table 7 shows the response of the accessions to powdery mildew as affected by EM_1 application. No significant difference was observed on the two treatments since both had a rating of moderate resistance to powdery mildew.

Effect of accession. It was observed that all accessions were moderately resistant to powdery mildew, except accession CGP 34 which was moderately susceptible to the disease. This can be attributed to the plant characteristic, it was observed that CGP 34 had a softer stem texture when compared to CLG.

Interaction effect. There were no significant interaction noted on EM_1 application and the garden pea accessions in their response to powdery mildew. Results showed moderate resistance to moderately susceptible response.

Reaction to Pod Borer

Effect of EM_1. There was no significant response noted as an effect of application and non- application of EM_1 on pod borer occurrence (Table 7).

Effect of accession. Table 7 shows the response of the accessions to pod borer. It was noted that there was a significant difference manifested by the accessions on pod borer incidence. Four accessions were moderately resistant while CGP 34 was moderately susceptible to pod borer.

Interaction effect. No significant interaction was observed on pod borer occurrence as an effect of EM_1 application and garden pea accessions.

Table 7. Reaction to powdery mildew and pod borer incidence of the garden pea accessions applied with EM_1

TREATMENT	PEST RATING	
	POWDERY MILDEW	POD BORER
EM_1 TREATMENT (PT)		
with EM_1	3	3
without EM_1	3	3
GARDEN PEA ACCESSION (GPA)		
CLG	3^b	3^b
CGP110	3^b	3^b
CGP116	3^b	3^b
CGP34	4^a	4^a
CGP18-A	3^b	3^b
PT x GPA	ns	ns
CV a (%)	6.06	6.06
CV b (%)	13.61	13.61

Means with the same letter/s are not significantly different at 5% level by DMRT
Rating scale: 1 highly resistant, 2 mildly resistant, 3 moderately resistant,4 moderately susceptible,5 very susceptible

Weight of Marketable Pods

Effect of EM_1. There was a significant difference noted on the weight of the marketable pods harvested as a result of application and non-application of EM_1 (Table 7). Plants applied with EM_1 produced higher marketable pods. This may be attributed to the higher number of harvest and pods harvested per plant of garden peas.

Effect of accession. The accessions significantly differed in their harvested marketable pods. Accession CGP 116 produced the highest weight of marketable pods among the five accessions, followed by CGP 34 and CGP 18-A which had comparable weights of marketable pods. Meanwhile accession CGP 110 produced the least

marketable pods. This result is with reference to their pod length and width. It was observed that CGP 116 and CGP 18-A and CGP 34 produced bigger and heavier pods in comparison to the pods produced by CLG and CGP 110 (Table 7).

Interaction effect. The interaction between the EM_1 treatment and the accessions were not significant on the marketable pods harvested.

Weight of Non-marketable Pods

Effect of EM_1. The table shows that there was no significant difference noted on the non-marketable pods harvested as an effect of EM_1 application. Plants applied with EM_1 had a higher non-marketable pods harvested.

Effect of accessions. The different garden pea accessions had a highly significant difference on the weight of non-marketable pods produced. Accession CGP 116 had the highest non-marketable pods harvested, followed by CGP 34 (Table 8).

Interaction effect. No interaction effect was realized on the weight of non-marketable pods harvested as affected by EM_1 application and garden pea accessions.

Table 8. Pod yield of garden pea accessions applied and not applied with EM_1

TREATMENT	TOTAL WEIGHT OF (g)	
	MARKETABLE	NON-MARKETABLE
EM_1 TREATMENT (PT)		
With EM_1	185.53[a]	642.87
Without EM_1	156.07[b]	560.33
GARDEN PEA ACCESSION (GPA)		
CLG	151.50[bc]	604.17[b]
CGP110	122.33[c]	443.17[c]
CGP116	217.50[a]	806.17[a]
CGP34	181.83[b]	654.83[b]
CGP18-A	180.83[b]	499.67[c]
PT x GPA	ns	ns
CV a (%)	10.18	12.05
CV b (%)	11.71	8.03

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

Total and Computed Yield

Effect of EM_1. Table 9 showed the total and computed yield of garden pea accessions applied with EM_1. There were no significant differences noted on the total and computed yield as an effect of application and non-application of EM_1. Although plants applied with EM_1 had higher total and computed yield. The recorded yield represents the first six harvest of the garden pea.

Effect of accessions. The different garden pea accessions exhibited highly significant differences on their total and computed yield. Accession CGP 116 which had the highest pod count also registered the highest weight of marketable and non-marketable pods.

Interaction effect. There was no significant interaction observed between the application of EM_1 and the accessions in terms of their total and computed yield.

Table 9. Total and computed yield of garden pea accessions applied with EM_1

TREATMENT	YIELD ($g/15\ m^2$)	COMPUTED YIELD (tons/ ha)
EM_1TREATMENT (PT)		
With EM_1	276.13	1.66
Without EM_1	238.80	1.43
GARDEN PEA ACCESSION (GPA)		
CLG	251.89^{bc}	1.51^{bc}
CGP110	188.50^{d}	1.13^{d}
CGP116	341.22^{a}	2.05^{a}
CGP34	278.83^{b}	1.67^{b}
CGP18-A	226.83^{c}	1.36^{c}
PT x GPA	ns	ns
CV a (%)	12.10	11.58
CV b (%)	7.91	7.90

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

Return on Cash Expense (ROCE)

Effect of EM_1. Table 10 shows that plants applied with EM_1 had higher total pod yield and gross sales but had a lower net income and ROCE because of the added cost of the EM_1 applied. Plants not applied with EM_1 had a higher net income and ROCE although they had a lower pod yield since it had a lower total expense incurred.

Effect of accession. Accession CGP 116 recorded the highest total pod yield among the five accessions, resulting to higher net income and ROCE. Meanwhile two

accessions realized a negative ROCE, namely CGP 110 and CGP 18-A. This was due to the low marketable, non-marketable and total pod yield produced by the accessions.

Table 10. ROCE of growing garden pea accessions applied with EM_1

TREATMENT	YIELD ($kg/15m^2$)	GROSS SALES (PhP)	TOTAL EXPENSES	NET INCOME	ROCE (%)
EM_1TREATMENT (PT)					
With EM_1	4.14	621	600	21	4
Without EM_1	3.58	537	400	87	19
ACCESSIONS (GPA)					
CLG	1.51	226	210	26	12
CGP110	1.13	170	210	-40	-19
CGP116	1.00	307	210	97	46
CGP34	1.67	251	210	41	20
CGP18-A	1.36	204	210	-6	-3

*Total expenses include: land preparation, seeds, cost of mushroom compost and cost of gasoline used in irrigation
* Priced at PhP 150/ kg (organic price) in the month of February 2009

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted to determine the growth and pod yield of the promising garden pea accessions under organic production; determine the effect of EM_1 on the growth and yield of garden pea accessions; determine the interaction of the garden pea accessions and EM_1application and; determine the profitability of growing the different garden pea accessions applied with EM_1.

The garden pea accessions had slight differences on the number of days to emergence. CGP 110 and CGP 18-A were the earliest to emerge. CGP 18-A was the earliest to bear flower. CLG was the earliest to develop pods and produced the most numerous pods per plant. Accession CGP 116 was the tallest of all the accessions, had the widest pods and produced the highest marketable, non-marketable and total yield.

Plants applied with EM_1 significantly had wider pods and higher marketable yield than those not applied with EM_1.

Result of the economic analysis showed a higher yield in the garden pea accessions applied with EM_1 but incurred higher total cost of production.

On the other hand, accession CGP 116 produced the highest yield and ROCE. Accession CGP 34 and CLG also had comparable yields and ROCE.

EM_1 application and the garden pea accessions interacted significantly only on the number of days to flowering, length and width of the pods. While no significant interaction was noted on the other vegetative and yield parameters gathered.

Conclusions

Application of EM_1 enhanced wider pods and marketable fresh pod yield of the garden pea accessions.

Results showed that CGP 116 was found as the best accession under organic production because of its wide pods, high fresh pod yield and ROCE, which exceeded the ROCE of CLG (check).

Producing CGP 116 with or without application of EM_1 may result to early pod setting and longer and wider pods.

Although application of EM_1 resulted to higher yield, growing garden peas without EM_1 application is still more profitable.

Recommendations

Based on the results, accession CGP116 is recommended for production under organic management.

The recommended garden pea accessions can be grown organically with or without EM_1 application. Application of EM_1 enhanced some beneficial effect on the growth and yield performance of the plants; however it served only as an added expense.

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APPENDICES

Appendix Table 1. Number of days from sowing to emergence of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	8	9	8	25	8.33
2.CGP 110	7	8	7	22	7.33
3.CGP 116	8	8	9	25	8.33
4.CGP 34	9	10	10	29	9.67
5.CGP 18-A	7	7	8	22	7.33
Sub Total	39	42	42		8.20
w/oEM_1					
1.CLG	8	8	8	24	8.00
2.CGP 110	7	7	7	21	7.00
3.CGP 116	9	8	8	25	8.33
4.CGP 34	10	10	10	30	10.00
5.CGP18-A	7	7	7	21	7.00
SUB TOTAL	41	40	40		8.07
GRAND TOTAL					8.14

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	8.33	8.00	16.33	8.17
2.CGP 110	7.33	7.00	14.33	7.17
3.CGP 116	8.33	8.33	16.66	8.33
4.CGP 34	9.67	10.00	19.67	9.84
5.CGP18-A	7.33	7.00	14.33	7.17
TOTAL	40.99	4.33	81.43	40.65
MEAN	8.20	8.07		8.14

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED 0.05	TABULATED 0.01
Replication	2	0.27	0.13			
EM_1 (A)	1	0.13	0.13	0.25	18.51	98.49
Error (a)	2	1.07	0.53			
Accessions (B)	4	28.80	7.20	43.20*	3.01	4.77
PT x GPA	4	0.53	0.13	0.80^{ns}	3.01	4.77
Error (b)	16	2.67	0.17			
TOTAL	29	33.47				

^{ns} – not significant
** - highly significant

C.V. (A)% = 8.98
C.V. (B)% = 5.02

Appendix Table 2. Number of Days from Emergence to First Flowering of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	50	51	49	150	50.00
2.CGP 110	48	49	47	144	48.00
3.CGP 116	52	52	53	157	52.33
4.CGP 34	51	51	52	154	51.33
5.CGP 18-A	39	40	39	118	39.33
SUB TOTAL	240	243	240		48.20
w/oEM_1					
1.CLG	49	51	51	151	50.33
2.CGP 110	50	49	49	148	49.33
3.CGP 116	52	53	52	157	52.33
4.CGP 34	50	52	51	153	51.00
5.CGP18-A	40	40	41	121	40.33
SUB TOTAL		245	244		48.67
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	50.00	50.33	100.33	50.17
2.CGP 110	48.00	49.33	97.99	48.67
3.CGP 116	52.33	52.33	104.66	52.33
4.CGP 34	51.33	51.00	102.33	51.17
5.CGP18-A	39.33	40.33	79.66	39.83
TOTAL	240.99	243.32	484.97	
MEAN	48.20	48.67		48.44

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATE D	
					0.05	0.01
Replication	2	2.467	1.233			
EM_1 (A)	1	1.633	1.633	7.0^{ns}	18.51	98.49
Error (a)	2	0.467	0.233			
Accessions (B)	4	598.200	149.550	245.83**	3.01	4.77
PT x GPA	4	2.867	0.717	1.18^{ns}	3.01	4.77
Error (b)	16	9.733	0.608			
TOTAL	29	615.367				

^{ns} – not significant
** - highly significant

C.V. (A)% = 1.06
C.V. (B)% = 1.61

Appendix Table 3: Number of days from flowering to pod setting of garden pea accession as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	6	7	7	20	6.67
2.CGP 110	9	8	8	25	8.33
3.CGP 116	9	9	8	27	9.00
4.CGP 34	8	9	10	27	9.00
5.CGP 18-A	9	8	9	26	8.67
SUB TOTAL	41	41	41		41.67
w/oEM_1					
1.CLG	8	9	7	24	8.00
2.CGP 110	10	9	8	27	9.00
3.CGP 116	9	10	9	28	9.43
4.CGP 34	9	8	7	24	8.00
5.CGP18-A	7	7	8	22	7.33
SUB TOTAL	43	43	39		34.46
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	6.67	8.00	14.67	7^{b}
2.CGP 110	8.33	9.00	17.33	9^{a}
3.CGP 116	9.00	9.43	18.33	9^{a}
4.CGP 34	9.00	8.00	17.00	9^{a}
5.CGP18-A	8.67	7.33	16.00	8^{ab}
TOTAL	41.67	41.76	83.33	
MEAN	41.67^{ns}	34.46^{b}		38.07

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED 0.05	TABULATED 0.01
Replication	2	0.60	0.30			
EM_1 (A)	1	0.03	0.03	0.04^{ns}	18.51	9.49
Error (a)	2	1.67	0.83			
Accessions (B)	4	10.13	2.53	4.16*	3.01	4.77
PT x GPA	4	8.13	2.03	3.34*	3.01	4.77
Error (b)	16	9.73	0.61			
TOTAL	29	30.30				

^{ns} – not significant
** - highly significant

C.V. (A)% = 11.28
C.V. (B) % = 9.40

Appendix Table 4. Height at maturity of garden pea accessions as affected by application of EM_1(cm)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	122	132	134	388	129
2.CGP 110	109	112	108	329	110
3.CGP 116	136	144	134	414	138
4.CGP 34	122	132	134	388	129
5.CGP 18-A	116	121	115	352	117
SUB TOTAL	605	642	622		124.60
w/oEM_1					
1.CLG	118	113	108	339	113
2.CGP 110	112	101	91	304	101
3.CGP 116	125	124	124	373	124
4.CGP 34	124	128	119	371	124
5.CGP18-A	96	102	112	310	103
SUB TOTAL		568	554		113
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	WP	WOP		
1.CLG	129	113	242	121.00
2.CGP 110	110	101	211	105.50
3.CGP 116	138	124	262	131.00
4.CGP 34	129	124	253	126.50
5.CGP18-A	117	103	220	110.00
TOTAL	623	565	1,188	
MEAN	124.6	113	237.60	118.80

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED 0.05	TABULATED 0.01
Replication	2	58.07	29.03			
EM_1 (A)	1	1009.20	1009.20	17.13^{ns}		
Error (a)	2	117.80	58.90			
Accessions (B)	4	2797.87	699.47	21.62**	3.01	4.77
PT x GPA	4	117.47	29.37	0.91^{ns}	3.01	4.77
Error (b)	16	517.47	32.34			
TOTAL	29	30.30				

^{ns} – not significant
** - highly significant

C.V. (A)% = 6.45
C.V. (B) % = 4.78

Appendix Table 5.Number of harvest of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	6	5	6	17	6
2.CGP 110	5	6	4	15	5
3.CGP 116	6	6	6	18	6
4.CGP 34	6	6	6	18	6
5.CGP 18-A	6	5	4	15	5
SUB TOTAL	29	28	26	83	5.6
w/oEM_1					
1.CLG	6	5	5	16	5
2.CGP 110	5	4	4	13	4
3.CGP 116	6	6	5	17	6
4.CGP 34	6	5	5	16	5
5.CGP18-A	5	5	4	14	5
SUB TOTAL	28	24	23	76	5
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	6	5	11	5.5
2.CGP 110	5	4	9	4.5
3.CGP 116	6	6	12	6.0
4.CGP 34	6	5	11	5.5
5.CGP18-A	5	5	10	5.0
TOTAL	28	25	53	
MEAN	5.6	5.0		5.3

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	3.20	1.60			
EM_1 (A)	1	1.63	1.63	12.25^{ns}	18.51	98.49
Error (a)	2	0.27	0.13			
Accessions (B)	4	6.47	1.62	5.71**	3.01	4.77
PT x GPA	4	0.20	0.50	0.18^{ns}	3.01	4.77
Error (b)	16	4.53	0.28			
TOTAL	29	16.30				

^{ns} - not significant
* - significant

C.V. (A)% = 6.88
C.V. (B) % = 10.04

Appendix Table 6. Total number of harvested pods per plant of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	29	26	23	78	26
2.CGP 110	21	14	16	51	17
3.CGP 116	27	30	28	85	28
4.CGP 34	25	26	22	73	24
5.CGP 18-A	15	18	15	50	17
Sub Total	117	114	104	337	22
w/oEM_1					
1.CLG	27	25	22	74	24
2.CGP 110	20	18	13	51	18
3.CGP 116	26	28	23	77	25
4.CGP 34	21	22	20	63	21
5.CGP18-A	16	15	13	44	15
Sub Total	110	108	91	309	21
GRAND TOTAL	227	222	195		21

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	26	24	50	25
2.CGP 110	17	18	35	17.5
3.CGP 116	28	25	53	26.5
4.CGP 34	24	21	45	22.5
5.CGP18-A	17	15	32	16
TOTAL	112	103	215	
MEAN				21.5

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREED0M	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	8.47	4.233			
EM_1 (A)	1	8.53	8.533	13.47^{ns}	18.51	98.49
Error (a)	2	1.27	0.633			
Accessions (B)	4	20.80	5.200	9.31**	3.01	4.77
PT x GPA	4	1.47	0.367	0.66^{ns}	3.01	4.77
Error (b)	16	8.93	0.558			
TOTAL	29	49.47				

^{ns} - not significant
* - significant

C.V. (A)% = 13.56
C.V. (B)% = 12.74

Appendix Table 7. Pod length of garden pea accessions as affected by application of EM_1 (cm)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	6.72	6.70	6.75	20.15	6.72
2.CGP 110	7.44	7.46	7.45	22.35	7.45
3.CGP 116	7.84	7.80	7.82	23.46	7.82
4.CGP 34	8.14	8.15	8.13	24.42	8.14
5.CGP 18-A	8.28	8.26	8.29	24.83	8.28
SUB TOTAL	38.42	38.37	38.42		7.68
w/oEM_1					
1.CLG	6.86	7.80	7.84	22.5	7.50
2.CGP 110	7.22	7.20	7.19	21.61	7.20
3.CGP 116	7.40	7.38	7.41	22.19	7.40
4.CGP 34	7.48	7.46	7.49	22.43	7.48
5.CGP18-A	8.10	8.14	8.12	24.36	8.12
SUB TOTAL	37.06	37.99	8.05		7.54
GRAND TOTAL					

PT x GPA TWO WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	6.72	7.50	14.22	7.11^{cd}
2.CGP 110	7.45	7.20	14.65	7.33^{cd}
3.CGP 116	7.82	7.40	15.25	7.61^{bc}
4.CGP 34	8.14	7.48	15.60	7.81^{b}
5.CGP18-A	8.28	8.12	16.40	8.20^{a}
TOTAL	38.41	37.7	76.11	
MEAN	7.68^{a}	7.54^{b}		7.61

ANALYSIS OF VARIANCE

SOURCES OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	0.06	0.030			
EM_1 (A)	1	0.15	0.153	4.87^{ns}	18.51	98.49
Error (a)	2	0.06	0.031			
Accessions (B)	4	4.28	1.071	34.43**	3.01	4.77
PT x GPA	4	1.81	0.452	14.54**	3.01	4.77
Error (b)	16	0.50	0.031			
TOTAL	29	6.87				

^{ns} - not significant
* - significant

C.V. (A)% = 2.31
C.V. (B)% = 02.32

Appendix Table 8. Pod width of garden pea accessions as affected by application of EM_1(cm)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	1.36	1.38	1.36	4.1	1.37
2.CGP 110	1.34	1.35	1.33	4.02	1.34
3.CGP 116	1.60	1.58	1.57	4.75	1.58
4.CGP 34	1.26	1.24	1.25	3.75	1.25
5.CGP 18-A	1.52	1.50	1.51	3.53	1.51
SUB TOTAL	7.08	7.05	7.02	20.15	1.41
w/oEM_1					
1.CLG	1.34	1.35	1.37	4.06	1.35
2.CGP 110	1.38	1.35	1.38	4.11	1.37
3.CGP 116	1.51	1.47	1.52	4.50	1.50
4.CGP 34	1.35	1.33	1.34	4.02	1.34
5.CGP18-A	1.28	1.25	1.26	3.79	1.26
SUB TOTAL	6.86	6.75	6.87	20.48	1.36
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	1.37	1.35	2.72	1.36[b]
2.CGP 110	1.34	1.37	2.71	1.36[b]
3.CGP 116	1.58	1.50	3.08	1.52[a]
4.CGP 34	1.25	1.34	2.59	1.30[c]
5.CGP18-A	1.51	1.26	2.77	1.39[b]
TOTAL	7.05	6.82	13.87	
MEAN	1.41[a]	1.36[b]		1.39

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	0.01	0.01			
EM_1 (A)	1	0.02	0.01	26.56*	18.51	98.49
Error (a)	2	0.01	0.01			
Accessions (B)	4	0.21	0.05	351.12**	3.01	4.77
PT x GPA	4	0.10	0.03	172.26**	3.01	4.77
Error (b)	16	0.02	0.00			
TOTAL	29	0.32				

[ns] - not significant
* - significant

C.V. (A)% = 2.27
C.V. (B)% = 0.87

Appendix Table 9. Reaction of the garden pea accessions to powdery mildew as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	3	3	3	9	3
2.CGP 110	2	3	3	8	3
3.CGP 116	3	3	3	9	3
4.CGP 34	4	3	4	11	4
5.CGP 18-A	3	3	3	9	3
SUB TOTAL	15	15	16	46	3.2
w/oEM_1					
1.CLG	3	2	3	8	3
2.CGP 110	3	3	3	9	3
3.CGP 116	3	3	3	9	3
4.CGP 34	3	4	4	11	4
5.CGP18-A	2	2	3	7	2
SUB TOTAL	14	14	16	44	5
GRAND TOTAL	29	29	32	90	4.1

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	3	3	6	3.0
2.CGP 110	3	3	6	3.0
3.CGP 116	3	3	6	3.0
4.CGP 34	4	4	8	4.0
5.CGP18-A	3	2	5	2.5
TOTAL	16	15	31	
MEAN	3.2	5.0		4.1

ANALYSIS OF VARIANCE

SOURCES OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	0.60	0.30			
EM_1 (A)	1	0.13	0.13	4.00^{ns}	18.51	98.49
Error (a)	2	0.07	0.03			
Accessions (B)	4	3.67	0.92	5.50**	3.01	4.77
PT x GPA	4	0.87	0.22	1.30^{ns}	3.01	4.77
Error (b)	16	2.67	0.17			
TOTAL	29	8.0				

^{ns} - not significant
* - significant

C.V. (A)% = 6.06
C.V. (B)% = 13.61

Appendix Table 10. Pod borer infestation of the garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	3	3	3	9	3
2.CGP 110	2	3	3	8	3
3.CGP 116	3	3	3	9	3
4.CGP 34	4	3	4	11	4
5.CGP 18-A	3	3	3	9	3
SUB TOTAL	15	15	16	46	3.2
w/oEM_1					
1.CLG	3	2	3	8	3
2.CGP 110	3	3	3	9	3
3.CGP 116	3	3	3	9	3
4.CGP 34	3	4	4	11	4
5.CGP18-A	2	2	3	7	2
SUB TOTAL	14	14	16	44	5
GRAND TOTAL	29	29	32	90	4.1

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	3	3	6	3.0
2.CGP 110	3	3	6	3.0
3.CGP 116	3	3	6	3.0
4.CGP 34	4	4	8	4.0
5.CGP18-A	3	2	5	2.5
TOTAL	16	15	31	
MEAN	3.2	5.0		4.1

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	0.60	0.30			
EM_1 (A)	1	0.13	0.13	4.00^{ns}	18.51	98.49
Error (a)	2	0.07	0.03			
Accessions (B)	4	3.67	0.92	5.50**	3.01	4.77
PT x GPA	4	0.87	0.22	1.30^{ns}	3.01	4.77
Error (b)	16	2.67	0.17			
TOTAL	29	8.00				

^{ns} - not significant
* - significant

C.V. (A)% = 6.06
C.V. (B)% = 13.61

Appendix Table 11. Weight of Marketable pods/plot of garden pea accessions as affected by application of EM_1 ($g/5m^2$)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	134	151	182	468	156
2.CGP 110	121	123	157	401	134
3.CGP 116	225	277	253	755	251
4.CGP 34	160	248	219	627	209
5.CGP 18-A	192	168	173	533	178
Sub Total	832	967	984		185.60
w/oEM_1					
1.CLG	159	139	144	442	147
2.CGP 110	93	109	131	333	111
3.CGP 116	170	186	194	550	183
4.CGP 34	140	151	173	464	155
5.CGP18-A	185	193	174	550	183
Sub Total	747	778	816		56.00
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	156	147	303	151.50
2.CGP 110	134	111	243	122.50
3.CGP 116	251	183	436	218.0
4.CGP 34	209	155	364	182.00
5.CGP18-A	178	183	361	180.50
TOTAL	928	779	1709	928
MEAN	185.60	156.07		170.84

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTE D F	TABULATED 0.05	TABULATED 0.01
Replication	2	2647.40	1323.70			
EM_1 (A)	1	6512.13	6512.13	21.53^{ns}	18.51	98.49
Error (a)	2	604.87	302.43			
Accessions (B)	4	30748.80	7687.20	19.10**	3.01	4.77
PT x GPA	4	5855.20	1463.80	3.64^{ns}	3.01	4.77
Error (b)	16	6438.40	402.40			
TOTAL	29	30.30				

^{ns} - not significant
* - significant
**- highly significant

C.V. (A)% = 10.18
C.V. (B)% = 11.74

Appendix Table 12. Weight of non-marketable pods/plot of garden pea accessions as affected by application of EM_1 ($g/5m^2$)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	643	710	684	2037	679
2.CGP 110	463	490	515	1468	489
3.CGP 116	835	856	780	2471	824
4.CGP 34	550	760	787	2097	699
5.CGP 18-A	490	520	560	1570	523
SUB TOTAL	2981	3336	3326		642.8
w/oEM_1					
1.CLG	568	525	495	1188	529
2.CGP 110	385	356	450	1191	397
3.CGP 116	760	810	796	2356	785
4.CGP 34	615	630	587	1832	611
5.CGP18-A	505	473	450	1428	476
SUB TOTAL					
GRAND TOTAL					

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	679	529	1208	604.00
2.CGP 110	489	397	886	443.00
3.CGP 116	824	785	1609	804.50
4.CGP 34	699	611	1310	655.00
5.CGP18-A	523	476	999	499.5
TOTAL	3211	2798	6012	
MEAN	642.8	559.6		601.2

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	6154.40	3077.20			
EM_1 (A)	1	51088.13	51088.13	9.72^{ns}	18.51	98.49
Error (a)	2	10509.07	5254.53			
Accessions (B)	4	481076.53	120269.13	51.56**	3.01	4.77
PT x GPA	4	12202.53	3050.63	1.31^{ns}	3.01	4.77
Error (b)	16	37320.53	2332.53			
TOTAL	29	598351.2				

^{ns} - not significant
* - significant

C.V. (A)% = 12.05
C.V. (B)% = 8.03

Appendix Table 13. Total yield of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	777	861	866	2504	835
2.CGP 110	584	613	672	1869	623
3.CGP 116	1060	1133	1033	3226	1075
4.CGP 34	710	1008	1006	2724	908
5.CGP 18-A	682	688	733	2103	701
SUB TOTAL	3813	4303	4310	12426	4142
w/oEM_1					
1.CLG	727	664	639	2030	677
2.CGP 110	478	465	581	1524	508
3.CGP 116	930	996	990	2916	972
4.CGP 34	755	781	760	2296	765
5.CGP18-A	690	666	624	1980	660
SUB TOTAL	3580	3572	3594	10746	3582
GRAND TOTAL	7393	7875	7904	23172	7724

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	2504	677	3181	1591
2.CGP 110	1869	508	2377	1189
3.CGP 116	3226	972	4198	2099
4.CGP 34	2724	765	3489	1745
5.CGP18-A	2103	660	2763	1382
TOTAL	12426	3582	3181	
MEAN	2485	716		

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	16476.20	8238.10			
EM_1 (A)	1	94080.00	94080.00	11.72^{ns}	18.51	98.49
Error (a)	2	16050.60	8025.30			
Accessions (B)	4	712790.20	178197.55	47.78**	3.01	4.77
PT x GPA	4	12272.33	3068.08	0.82^{ns}	3.01	4.77
Error (b)	16	59677.87	3729.87			
TOTAL	29	6.87				

^{ns} - not significant
* - significant

C.V. (A)% = 12.40
C.V. (B)% = 7.91

Appendix Table 14. Computed Yield (tons/ha) of garden pea accessions as affected by application of EM_1

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
w/EM_1					
1.CLG	1.55	1.72	1.73	5.01	1.67
2.CGP 110	1.17	1.23	1.34	3.74	1.25
3.CGP 116	2.12	2.27	2.07	6.43	2.15
4.CGP 34	1.42	2.02	2.01	5.45	1.82
5.CGP 18-A	1.36	1.38	1.47	4.21	1.40
SUB TOTAL	7.63	8.61	8.62	24.85	8.28
w/o EM_1					
1.CLG	1.45	1.33	1.29	4.06	1.35
2.CGP 110	956	.93	1.16	3.05	1.02
3.CGP 116	1.86	1.99	1.98	5.83	1.94
4.CGP 34	1.51	1.56	1.52	4.59	1.53
5.CGP18-A	1.38	1.33	1.25	3.96	1.32
SUB TOTAL	7.16	7.14	7.19	21.49	7.16
GRAND TOTAL	14,786	15,786	15,808	46,344	15,448

PT x GPA TWO-WAY TABLE

ACCESSIONS	TREATMENTS		TOTAL	MEAN
	w/EM_1	w/oEM_1		
1.CLG	5.01	4.06	9.07	4.53
2.CGP 110	3.74	3.05	6.79	3.39
3.CGP 116	6.45	5.83	12.28	6.14
4.CGP 34	5.45	4.59	10.04	5.02
5.CGP18-A	4.21	3.96	8.166	4.53
TOTAL	24.85	21.49	9.07	
MEAN	4.790	4.298		

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	COMPUTED F	TABULATED	
					0.05	0.01
Replication	2	0.066	0.033			
EM_1 (A)	1	0.375	0.375	11.60^{ns}	18.51	98.49
Error (a)	2	0.065	0.032			
Accessions (B)	4	2.854	0.713	47.97**	3.01	4.77
PT x GPA	4	0.049	0.012	0.83^{ns}	3.01	4.77
Error (b)	16	0.238	0.015			
TOTAL	29	6.867				

^{ns} - not significant
* - significant

C.V. (A)% = 11.58
C.V. (B) % = 7.90

Appendix Table 15. Return on cash expense

Treatment	Yield ($g/15m^2$)	Gross Sales (PhP)	Total Expenses ($15m^2$)	Net income	ROCE (%)
w/EM_1					
1. CLG	835	125.25	120	5.25	4.38
2. CGP 110	623	93.45	120	-26.55	-22.13
3. CGP 116	1,075	161.25	120	41.25	34.38
4. CGP 34	908	136.20	120	16.20	13.50
5. CGP 18-A	701	105.15	120	-48.85	-12.38
w/oEM_1					
1. CLG	677	101.55	90	11.55	12.83
2. CGP 110	508	76.20	90	-13.80	-15.33
3. CGP 116	972	145.80	90	55.80	62.00
4. CGP 34	765	114.75	90	24.75	27.50
5. CGP 18-A	660	99	90	9.00	10.00

*Total expenses include: land preparation, seeds, cost of mushroom compost and cost of gasoline used in irrigation

* Priced at PhP 150/ kg (organic price) in the month of February 2009