BIBLIOGRAPHY

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ABSTRACT

The study was conducted at Bangao, Buguias, Benguet to evaluate the growth and yield of garden pea entries sprayed with seaweed extract and oriental herbal nutrients; determine the effect of spraying seaweed extract and OHN on the growth and yield of garden pea; determine the interaction effect of garden pea entries and spraying of seaweed extract and OHN on the growth and yield of garden pea; and determine the profitability of garden pea production sprayed with seaweed extract and OHN.

Based on the results of the study, among the garden pea entries evaluated CGP 151 and Betag are moderately resistant to powdery mildew and have the highest weight of marketable pods and total yield. Garden pea entries sprayed with seaweed extract and OHN showed significant differences on plant height, marketable yield and total yield. There is no interaction effect of garden pea entries and spraying seaweed extract and OHN on the growth and yield of garden pea. However, application of Seaweed extract and OHN for garden pea production is not profitable.

Under Bangao, Buguias, Benguet condition, Betag and CGP 151 garden pea entries are recommended in terms of yield and profitability.

INTRODUCTION

Garden pea (*Pisum sativum*) is an annual legume grown for its edible pods or seeds which are used as vegetables. In other countries, garden pea is also grown for its mature peas, which are cooked as an ingredient of soups, broths, and finger foods. It grows well in cool climate and also helps maintain and conserve soil fertility because of its ability to fix free nitrogen from the atmosphere through the action of nitrogen fixing bacteria present in its roots (Ware and Swaider, 2002).

The yield of garden pea may be affected by the cultivar and certain cultural management practices. Pest is one of the problems of farmers in Benguet and Mountain Province. To obtain high yield, farmers use chemical pesticides and fuel-based-fertilizers which result in destroying the chemistry of the soil, causes pollution and lead to deficiencies of certain microorganisms that play a role in making nutrients in the soil available to plants (Fertilizer and Pesticide Authority, 1985).

The application of Seaweed extract and Oriental Herbal Nutrients to nourish and to protect the plant from pests and diseases could be a way to prevent the problem. Seaweed extract is naturally made from plant materials which are acted by bacteria and yeasts to produce a liquid fertilizer (Michwave, 2010). It gives more nitrogen and phosphorus and enhances the ability of the plant to photosynthesize. On the other hand, Oriental Herbal Nutrients is made from herbs that are full of energy and function to increase plant robustness, to sterilize, and to keep plants warm (Cho, 2009).

In addition, identifying the exact variety of garden pea suitable for the cultural practices is also needed. The variety should give high yield and good quality pods.

The study aimed to:

1. evaluate the growth and yield of garden pea entries sprayed with Seaweed extract and Oriental Herbal Nutrients;

2. determine the effect of spraying Seaweed extract and Oriental Herbal Nutrients on the growth and yield of garden pea;

3. determine the interaction effect of garden pea entries and spraying Seaweed extract and Oriental Herbal Nutrients on the growth and yield of garden pea; and

4. determine the profitability of garden pea production sprayed with Seaweed extract and Oriental Herbal Nutrients.

The study was conducted at Bangao, Buguias, Benguet from October 2011 to February 2012.

REVIEW OF LITERATURE

Production of Garden Pea in the Philippines

In 2006, PCARRD stated that production this year of organic garden pea was 5,723 tons, down by 1.5 % from the output of the previous year at 5,808 tons and the area harvested was 1,674 ha, down by 1.4 % from 1,697 ha in 2005. The yield per hectare was 3.4 tons in 2006, the same level posted in 2005. The major producer was the Cordillera Administrative Region which accommodated 94.5 % of the production and 5.5 % from the other regions.

Climatic Requirements of Garden Pea

Garden pea is a crop that grows best in soil pH range from 5.5 to 6.0 that is friable, fertile, well drained and free from pests and diseases (Purseglove, 1972). It thrives best in areas at least 1,000 m above sea level and favors a cool climate with a temperature range of 10°- 18°C.

In 2002, Ware and Swaider stated that the growth of garden pea is generally affected by temperature, humidity and soil conditions. Different varieties may respond to the climate, which involve temperature, moisture and light.

Varietal selection

Knowing the best variety to plant must be the first decision in planting garden pea. The best variety that is adapted to the locality should be selected. As cited by Gibson (2003), the varieties to be selected should be highyielding, resistant to pest and diseases and early maturing. These traits could make possible the growing of the crop less expensive and more productive.

Varietal evaluation

In 2005, Paganas characterized and evaluated five commercially grown garden pea varieties in Benguet, Kalantao, CGP 39 and 89-001 significantly produced the highest number and weight of marketable pods per plot and thus recommended to garden pea growers in La Trinidad, Benguet, Kalantao, Chinese White, CGP 39 and 89-001 identified as high yielding varieties.

In 2006, Gawidan evaluated ten garden pea entries for fresh pod and seed yield under La Trinidad, Benguet condition. Significant differences were observed among the ten entries of garden pea evaluated in terms of number of days to first and last flowering, number of nodes to first flower, number of pods per plant, pod width and fresh pod yield per plot. N335, CGP 34, 89-001 and CLG produced the highest fresh pod yield per plot and per hectare. CGP 34 was observed to have moderate resistance against leaf miner and Ascochyta leaf spot.

In 2011, Donglal evaluated seven selected advanced lines of garden pea were characterized and evaluated based on their agro morphological characteristics, growth and fresh pod yield. Significant differences among the seven advanced lines of garden pea in term of fresh pod yield per plot was selected. Betag had the highest weight of marketable fresh pod yield per plot (2.02kg/5m2). Other lines produced 1.54 to 1.82kg/5m2.

Oriental Herbal Nutrients

Oriental Herbal Nutrient or OHN is a natural pest repellant in growing crops. It is effective in strengthening the immune system of plants as well as animals. It is a good source of calcium, phosphorus, magnesium, manganese, sodium and iron that activates and revitalizes crops and it is good for all stages of plant growth (Sarian, 2009).

Seaweed extract as Organic Fertilizer

According to Michwave (2010), seaweed extract is an organic fertilizer that is cheap, easy-to-make and safe fertilizer which is naturally made from plant materials which are acted upon by bacteria and yeasts to produce a liquid form of fertilizer. It gives more nitrogen to plants and enhances the ability of plants to photosynthesize or make their own food, and also gives additional phosphorus and helps maintain vigor in plants and resistance against pests. It is rich in micronutrients like iodine, sodium, chloride, magnesium, manganese and others which are all essential in the balance growth of plants.

The nutrient content of seaweed extract used were 0.2-0.5% Nitrogen, 0.1-0.5% Phosphorus, 2-3% Potassium, 0.15% Calcium, 1% Sodium, 20 -60ppm Manganese, 0.1-0.4 Sulphur, 0.1-0.4 Iron and 4-20ppm Copper.

MATERIALS AND METHODS

An area of 150m^2 was thoroughly prepared and divided into 30 plots. Each plot measuring 1m x 5m was constructed to accommodate the 30 treatments. The treatments were laid out following the Split Plot Design with three replications.

The materials used in the study were seeds of five garden pea entries, trellis, twine or straw, seaweed extract, oriental herbal nutrients or (OHN), chicken manure, sprayer, grab hoe and bolos.

The treatments were the following:

Main plot- Seaweed Extract and OHN (F)

CODE	DESCRIPTION
F_1	With application of 50% Seaweed extract and 50% OHN
F_2	Without application of Seaweed extract and OHN

Subplot- Garden Pea Entries

CODE	ENTRY
E_1	BETAG
E_2	CGP 34
E_3	CGP 59
E_4	CGP 11
E_5	CGP 151

Cultural Management Practices

Chicken manure at a rate of 4kg per plot was applied as a basal fertilizer before planting the seed. The garden pea entries were planted at a distance of 20cm x 25cm between hills and rows (Figure 1). Right after full emergence, mixture of 3tbsp of Seaweed extract and 3tbsp of Oriental Herbal Nutrients diluted in 16 liters of water were sprayed every 6 days.

All other cultural management practices were done uniformly such as weeding and irrigation.

Figure 1. Overview of the experimental area at 36 DAP

Farm description

The farm is located at the lee side area. It was a conventional farm and it was previously planted with beans.

Data gathered:

1. Climatic Data. Temperature, relative humidity and amount of rainfall throughout the growing period were taken from Benguet State University-Buguias Campus, Loo, Buguias, Benguet.

2. Soil Analysis. This was collected before planting and after harvesting. Soil samples were analyzed for initial and final soil pH, organic matter, nitrogen, phosphorus and potassium contents.

3. Percent Survival. This was obtained using the following formula:

$$\%\text{Survival} = \frac{\text{Total number of plants per plot at 35 days after sowing}}{\text{Total number of seedling planted per plot}} \times 100$$

4. Maturity

a. Number of days from sowing to emergence. This was obtained by counting the number of days from sowing to emergence.

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

c. Number of days from emergence to last flowering. This was recorded by counting the number of emergence to last flowering when 50% of the plant per plot has stopped flowering.

d. Number of days from flowering to pod setting. This was obtained by counting the number of days from flowering until the pods begin to develop.

e. Number of days from flowering to first and to last harvesting. This was recorded by counting the number of days from flowering to first and to last harvesting.

5. Leaf characteristics

a. Leaflet length (cm). This was measured using a foot rule from the base of the petiole to the tip of the plant per treatment at 35 days after planting.

b. Leaflet width (cm). This was measured from the broadest part of the leaf at 35 days after planting.

6. Stem characteristics

a. Plant height. This was measured from the base of the plant at ground level to the tip of the youngest shoot using a meter stick at 35 days after planting and during the last harvest.

b. Number of nodes per plant. This was counted from the base of the plant to the tip of the main stem of the plants per treatment during the last harvest.

7. Flower characteristics

a. Number of flowers per cluster. The flowers per cluster were counted from the plants per plot.

8. Pod characteristics

a. Pod length (cm). This was obtained by measuring the length of the sample pods per treatment from the base to the tip of the pods.

b. Pod width (cm). This was obtained by measuring the broadest part of the sample pods used in gathering pod length using a foot rule.

c. Number of pods per cluster. This was obtained by getting the number of pods per cluster from the sample plants per plot.

9. Yield characteristics

a. Weight of marketable fresh pods per plot (kg/5m^2). This was recorded by weighing the marketable pods per plot from the first to last harvest. Marketable pods were smooth, well formed pods, and free from damages.

b. Weight of non- marketable pods per plot (kg/5m^2). This was obtained by weighing the non- marketable pods per plot per treatment. These were pods that were over-matured, malformed and damaged by insects and diseases.

c. Total yield per plot (kg/5m^2). This was recorded by getting the total weight of marketable and non-marketable pods per plot per treatment throughout the harvest period.

10. Reaction to leaf miner infestation. This was gathered using the following scale used by Paganas (2005).

SCALE	DESCRIPTION	REMARKS
1	no damage	highly tolerant
2	1-25% infestations	mildly tolerant
3	26-50% infestations	moderately tolerant
4	51-75% infestations	moderately susceptible
5	76-100% infestations	very susceptible

11. Reaction to Powdery Mildew. This was observed at 45 and 60 DAP following the scale used by Paganas (2005).

SCALE	DESCRIPTION	REMARKS
1	no damage	highly resistant
2	1-25% of the total leaves	mildly resistant

Per plant and per plot are infected

3	25-50% of the total leaves	moderately resistant

Per plant and per plot are infected

4	51-75% of the total leaves	moderately susceptible

Per plant and per plot are infected

5	76-100% of the total leaves	very susceptible

Per plant and per plot are infected

12. Return on cash expenses (ROCE). This was computed by subtracting the total expenses per $5m^2$ from the gross sale per plot divided by total expenses per plot then multiplied by one hundred.

$$\text{ROCE (\%)} = \frac{\text{Gross Sales- Total Expenses}}{\text{Total Expenses}} \times 100$$

Data Analysis

All quantitative data were analyzed using Analysis of Variance (ANOVA) for 2x5 Factorial in Split-Plot Design with three replications. The significance of differences among treatment means were tested using Duncan's Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Agro-Climatic Data

The temperature, amount of rainfall and relative humidity during the conduct of the study from October 2011 to February 2012 are shown in Table 1. The temperature range during the conduct of the study is from 10.3°C to 23.6°C. The temperature is within the temperature range that favors the growth of garden pea. The lowest minimum relative humidity is 48% and the maximum relative humidity is 97%. The total amount of rainfall recorded was declining from 9.37 mm in October 2011 to 1.53 mm in February 2012. Irrigation was done during the low rainfall period.

Table 1. Temperature, amount of rainfall, and relative humidity from October 2011 to February 2012

MONTH	TEMPERATURE (°C)		AMOUNT OF RAINFALL (mm)	RELATIVE HUMIDITY (%)	
	MIN	MAX		MIN	MAX
October	14.3	23.6	9.37	56	94
November	14.0	22.7	4.99	57	91
December	13.7	22.4	3.17	56	92
January	10.3	23.0	2.84	48	94
February	10.7	22.9	1.53	55	97

Soil Analysis

As shown in Table 2, the soil pH before the experiment was 4.97 and increased to pH 5.63 after the experiment which is within the pH range that favors the growth of garden pea. The percent organic matter before and after planting was 2.5% except for soils with no application of Seaweed extract and OHN (2.0%). In terms of nitrogen, no change was observed before and after on the application of Seaweed extract and OHN except for soil with no application of Seaweed extract and OHN. The phosphorus content of the soil after the experiment was increased from 130 ppm to as high as 410 ppm. There was a higher increase on the potassium content of soil applied with seaweed extract and OHN compared to without application. Increased in soil pH, percent organic matter, nitrogen, phosphorus and potassium after harvest may be due to the application of Seaweed extract and OHN.

Table 2. Soil physical properties before planting and after harvesting

	PH	ORGANIC MATTER (%)	NITRO-GEN (%)	PHOSPHO-RUS (ppm)	POTA-SSIUM (ppm)
Before planting	4.97	2.5	0.125	130	360
After harvesting Sprayed with Seaweed extract and OHN	5.57	2.0	0.100	380	648
After harvesting Not sprayed with Seaweed extract and OHN	5.63	2.5	0.125	410	696

Percent Survival

Effect of seaweed extract and OHN. There was no significant differences observed on the percent survival of garden pea entries applied and not applied with seaweed extract and OHN.

Effect of entry. Significant differences were observed among the five garden pea entries on percent survival (Table 3). Betag had a hundred percent survival but comparable to CGP 151 and CGP 34, however, they are significantly different to CGP 59 and CGP 11.

Table 3. Percent survival of five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	PLANT SURVIVAL (%)
Seaweed extract and OHN (F)	
Sprayed with Seaweed extract and OHN	97.38
Not sprayed with Seaweed extract and OHN	96.76
Entries (E)	
Betag	100.00[a]
CGP 34	96.00[a]
CGP 59	94.67[b]
CGP 11	94.91[b]
CGP 151	99.77[a]
(FxE)	ns
CV_a (%)	16.31
CV_b (%)	9.50

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Interaction effect. No significant interaction effect was observed between the garden pea entries and spraying of seaweed extract and OHN on percent survival.

Days from Sowing to Emergence

Effect of seaweed extract and OHN. There was no significant differences on the number of days from sowing to emergence observed among the garden pea entries sprayed and not sprayed with seaweed extract and OHN (Table 4). The garden pea plants emerged at 6 days after sowing.

Effect of entry. Most of the entries emerged six days from sowing except CGP 59 and CGP 11 which emerged seven days after sowing.

Interaction effect. No significant interaction effect of garden pea entries and spraying of seaweed extract and OHN on the number of days from sowing to emergence was observed.

Days from Emergence to First Flowering

Effect of seaweed extract and OHN. There was no significant differences on the number of days from emergence to first flowering. Garden pea entries sprayed and not sprayed with Seaweed extract and OHN start flowering at 30 days from emergence (Table 4).

Effect of entry. There were no significant differences observed on the number of days from emergence to first flowering. However, numerically, Betag and CGP 151 produced the first flowers at 36 days from emergence followed by CGP 59 and CGP 11 which flowered at 38 days from emergence and CGP 34 which flowered 42 days from emergence (Figure 2).

Interaction effect. No significant interaction effect was observed between the garden pea entries and spraying of seaweed extract and OHN on the number of days from emergence to first flowering.

Figure 2. Flowering of garden pea entries at 40 DAP

Days from Emergence to Last Flowering

Effect of seaweed extract and OHN. No significant differences on the number of days from emergence to last flowering of the garden pea entries sprayed and not sprayed with seaweed extract and OHN was observed (Table 4). The plants last flowered at 69 days from emergence.

Effect of entry. There were no significant differences observed among the entries. Numerically, Betag, CGP 11, CGP 59 and CGP 151 were the earliest to stop flowering at 68 days after emergence. The results indicate early senescence of the entry.

Table 4. Number of days from sowing to emergence, emergence to first flowering, and last flowering of five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	NUMBER OF DAYS		
	FROM SOWING TO EMERGENCE	FROM EMERGENCE TO FIRST FLOWERING	FROM EMERGENCE TO LAST FLOWERING
Seaweed extract and OHN (F)			
Sprayed with Seaweed extract and OHN	6	30	69
Not sprayed with Of Seaweed extract and OHN	6	30	69
Entries (E)			
Betag	6	36	68
CGP 34	6	42	71
CGP 59	7	38	68
CGP 11	7	38	68
CGP 151	6	36	68
(FxE)	ns	ns	ns
CV_a (%)	0	0	0
CV_b (%)	0	0	0

Interaction effect. No significant interaction effect of the garden pea entries and spraying of seaweed extract and OHN on the number of days from emergence to last flowering.

Days from Flowering to Pod Setting

Effect of seaweed extract and OHN. There was no significant differences between the garden pea entries sprayed and not sprayed with Seaweed extract and OHN. The plants produced pods nine days from flowering.

Effect of entry. There was no significant differences observed as an effect of the different entries of garden pea. However, CGP 151, Betag and CGP 59 produced pods earlier at 7 days after flowering since the entries flowered earlier than the other entries.

Interaction effect. No significant interaction effect of the garden pea entries and spraying of seaweed extract and OHN on the number of days from flowering to pod setting was observed.

Days from Flowering to First Harvesting

Effect of seaweed extract and OHN. No significant differences on the number of days from flowering to first harvest among the entries sprayed and not sprayed with seaweed extract and OHN were observed (Table 5). The plants were first harvested at 26 days from flowering.

Effect of entry. No significant differences were observed among the entries. However, numerically, CGP 151 was harvested first at 24 days after flowering followed by Betag and CGP 59 at 25 days after flowering which might be due to their early flowering and pod setting.

Interaction effect. No significant interaction effect was observed between the garden pea entries and spraying of seaweed extract and OHN on the number of days from flowering to first harvesting.

Table 5. Number of days from flowering to pod setting, first and last harvesting of five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	NUMBER OF DAYS FROM FLOWERING TO		
	POD SETTING	FIRST HARVEST	LAST HARVEST
Seaweed extract and OHN (F)			
Sprayed with Seaweed extract and OHN	9	26	38
Not sprayed with Seaweed extract and OHN	9	26	38
Entries (E)			
Betag	8	25	37
CGP 34	12	31	40
CGP 59	8	25	37
CGP 11	11	27	37
CGP 151	8	24	37
(FxE)	ns	ns	ns
CV_a (%)	0	0	0
CV_b (%)	0	0	0

Days from Flowering to Last Harvesting

Effect of seaweed extract and OHN. There was no significant differences on the number of days from flowering to last harvesting on the garden pea entries sprayed and not sprayed with seaweed extract and OHN (Table 5). The garden pea plants were last harvested at 38 days from flowering.

Effect of entry. Statistically, no significant differences were observed among the entries. All the entries were all harvested at 37 days from flowering except CGP 34 which was last harvested at 40 days from flowering due to late flowering and pod setting.

Interaction effect. There was no significant interaction effect observed between the garden pea entries and spraying of seaweed extract and OHN on the number of days from flowering to last harvesting.

Leaflet Length

Effect of seaweed extract and OHN. There was no significant differences observed on the leaflet length of garden pea plants sprayed with fertilizers (Table 6).

Effect of entry. Significant differences were observed on the leaflet length of the garden pea entries. Entry CGP 151 significantly had the longest leaflet (5.74 cm) but comparable with the leaflet of CGP 34 (5.43 cm). Entry CGP 11 had the shortest leaflet. The differences observed may be due to the genetic traits of each entry.

Interaction effect. There was no significant interaction effect of the garden pea entries and spraying of seaweed extract and OHN observed on the leaflet length of the garden pea.

Leaflet Width

Effect of seaweed extract and OHN. There was no significant differences observed on the leaflet width of plants sprayed and not sprayed with seaweed extract and OHN (Table 6).

Effect of entry. No significant differences were observed on the leaflet width of the different entries. However, CGP 151 had the widest leaflet while CGP 59 had the narrowest leaflet.

Interaction effect. There was no significant interaction effect between the garden pea entries and spraying of seaweed extract and OHN on leaflet width.

Table 6. Leaflet length and width of the five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	LEAFLET LENGTH AT 35 DAP (cm)	LEAFLET WIDTH AT 35 DAP (cm)
Seaweed extract and OHN (F)		
Sprayed with Seaweed extract and OHN	5.26	4.40
Not sprayed with Seaweed extract and OHN	5.28	4.40
Entries (E)		
Betag	5.23^{bc}	4.41
CGP 34	5.43^{ab}	4.37
CGP 59	5.00^{c}	4.17
CGP 11	5.00^{c}	4.30
CGP 151	5.74^{a}	4.75
(FxE)	ns	ns
CV_a (%)	10.48%	4.00%
CV_b (%)	5.98%	7.16%

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Plant Height at 35 and 70 DAP

Effect of seaweed extract and OHN. There were no significant differences on plant height at 35 DAP while at 70 DAP, significant differences were noted (Table 7). Garden pea entries sprayed with Seaweed extract and OHN are taller compared to garden pea entries not sprayed with Seaweed extract and OHN. This result is may be due to the application of Seaweed extract and OHN that supplied the nutrients needed by the plants.

Effect of entry. There were significant differences observed on the plant height at 35 DAP and at 70 DAP of the garden pea entries. Entry CGP 34 is significantly taller at 35 DAP and at 70 DAP compared to all other entries. The differences is may be due to the genetic make-up of the entries.

Interaction effect. There was no interaction effect of garden pea entries and spraying of seaweed extract and OHN on the plant height at 35 DAP and at 70 DAP of garden pea.

Table 7. Plant height of the five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	PLANT HEIGHT (cm)	
	35 DAP	70 DAP
Seaweed extract and OHN (F)		
Sprayed with Seaweed extract and OHN	42.65	181.86[a]
Not sprayed with Seaweed extract and OHN	41.14	178.71[b]
Entries (E)		
Betag	40.39[b]	176.33[b]
CGP 34	46.26[a]	191.71[a]
CGP 59	42.38[b]	179.17[b]
CGP 11	40.20[b]	176.80[b]
CGP 151	40.25[b]	177.43[b]
(FxE)	ns	ns
CV_a (%)	2.57%	0.75%
CV_b (%)	5.38%	2.73%

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Number of Flowers per Cluster

Effect of seaweed extract and OHN. No significant differences was observed on the number of flowers per cluster of the garden pea entries sprayed and not sprayed with seaweed extract and OHN (Table 8).

Effect of entry. There were no significant differences observed on the number of flowers per cluster among the garden pea entries. All the entries produced one flower per cluster except CGP 34 with two flowers (Figure 3).

Table 8. Number of flowers per cluster, number of pods per cluster and number of nodes per plant of the five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	NUMBER OF		
	FLOWERS PER CLUSTER	PODS PER CLUSTER	NODES PER PLANT
Seaweed extract and OHN (F)			
Sprayed with Seaweed extract and OHN	1	1	21
Not sprayed with Seaweed extract and OHN	1	1	21
Entries (E)			
Betag	1	1	22[a]
CGP 34	2	2	23[a]
CGP 59	1	1	20[b]
CGP 11	1	1	20[b]
CGP 151	1	1	20[b]
(FxE)	ns	ns	ns
CV_a (%)	0	0	3.10
CV_b (%)	0	0	5.27

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Interaction effect. No significant interaction effect was observed between the garden pea entries and spraying of seaweed extract and OHN on the number of flowers per cluster.

Number of Pods per Cluster

Effect of seaweed extract and OHN. There was no significant differences observed on the number of pods per cluster. All the garden pea entries produced one pod per cluster whether plants were applied with seaweed extract and OHN or not (Table 8).

Effect of entry. No significant differences were observed on the number of pods per cluster among the garden pea entries. All the entries produced one pod per cluster except CGP 34 which produced two pods.

Interaction effect. No significant interaction was observed between the garden pea entries and spraying of seaweed extract and OHN on the number of pods per cluster of garden pea.

Number of Nodes per Plant

Effect of seaweed extract and OHN. No significant differences was observed among the garden pea entries sprayed and not sprayed with seaweed extract and OHN on the number of nodes per plant (Table 8).

Effect of entry. There were significant differences observed on the number of nodes per plant. CGP 34 and Betag entries were not significantly different but are significantly different to CGP 59, CGP 11 and CGP 151. This is may be due to varietal differences of the crop.

Figure 3. Flowers of the garden pea entries

Interaction effect. It was observed that there was no significant interaction effect of garden pea entries and spraying of seaweed extract and OHN on the number of nodes per plant of the garden pea.

Pod Length

Effect of seaweed extract and OHN. No significant differences were observed on the pod length of garden pea plants sprayed with fertilizers (Table 9). However, pods of garden pea entries sprayed with seaweed extract and OHN are longer compared to garden pea entries not sprayed with seaweed extract and OHN.

Effect of entry. There were significant differences observed on the pod length of the entries. Entry Betag produced the longest pods (8.92 cm) followed by CGP 151, while CGP 34, CGP 59 and CGP 11 entries produced the shortest pods. This result is may be due to the varietal differences of the plants.

Interaction effect. No significant interaction effect of garden pea entries and spraying of seaweed extract and OHN was observed on the pod length of garden pea.

Table 9. Pod length and width of the five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	POD LENGTH (cm)	POD WIDTH (cm)
Seaweed extract and OHN (F)		
Sprayed with Seaweed extract and OHN	8.03	1.60
Not sprayed with Seaweed extract and OHN	7.93	1.60
Entries (E)		
Betag	8.92[a]	1.66[a]
CGP 34	7.55[c]	1.53[c]
CGP 59	7.62[c]	1.58[bc]
CGP 11	7.63[c]	1.57[bc]
CGP 151	8.20[b]	1.62[ab]
(FxE)	ns	ns
CV_a (%)	4.90	0.00
CV_b (%)	3.32	2.44

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Pod Width

Effect of seaweed extract and OHN. No significant differences was observed on the pod width of garden pea entries sprayed and not sprayed with seaweed extract and OHN. The pod width of both treatments is 1.60 cm.

Effect of entry. Significant differences were observed on the pod width of the different entries. Entry Betag had the significantly widest pods (1.66 cm) but comparable to the pod

width of entry CGP 151. CGP 34 produced the narrowest pods. Wide pods may contribute to high weight of pods and produce more profit.

Interaction effect. No significant interaction effect of garden pea entries and spraying of seaweed extract and OHN was observed on the pod width of garden pea.

Weight of Marketable Pods per Plot

Effect of seaweed extract and OHN. There was a significant differences observed on the weight of marketable pods per plot of plants sprayed and not sprayed with seaweed extract and OHN (Table 10). Garden pea entries sprayed with Seaweed extract and OHN significantly had the higher weight of marketable pods compared to garden pea entries not sprayed with Seaweed extract and OHN. The differences could be due to the nutrients from seaweed extract and OHN as a protection from pest and diseases.

Effect of entry. Significant differences were observed on the weight of marketable pods per plot of the garden pea entries. Betag and CGP 151 entries significantly produced the highest weight of marketable pods (Figure 4 and 5).

Interaction effect. No significant interaction effect was observed between the garden pea entries and spraying of seaweed extract and OHN on the weight of marketable pods per plot on garden pea.

Weight of Non-Marketable Pods per Plot

Effect of seaweed extract and OHN. No significant differences was observed on the weight of non- marketable pods per plot of garden pea entries sprayed and not sprayed with seaweed extract and OHN (Table 10).

Effect of entry. There were significant differences observed on the weight of non-marketable pods among the different entries of garden pea. Entry Betag had the highest

weight of non-marketable pods followed by CGP 59 and CGP 151. CGP 34 and CGP 11 have the lowest weight of non-marketable pods.

Interaction effect. No significant interaction effect of garden pea entries and spraying of seaweed extract and OHN was observed on the weight of non-marketable pods per plot.

a

b

c

d

e

Figure 4. Marketable fresh pods of the five garden pea entries Betag (a), CGP 34 (b), CGP 59 (c), CGP 11 (d) and CGP 151 (e) sprayed with Seaweed extract and OHN

a

b

c

d

e

Figure 5. Marketable fresh pods of the five garden pea entries Betag (a), CGP 34 (b), CGP 59 (c), CGP 11 (d) and CGP 151 (e) not sprayed with Seaweed extract and OHN

Table 10. Weight of marketable and non-marketable pods, total yield and computed yield of five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	MARKETABLE PODS ($kg/5m^2$)	NON MARKETABLE PODS ($kg/5m^2$)	TOTAL YIELD ($kg/5m^2$)	COMPUTED YIELD (t/ha)
Seaweed extract and OHN (F)				
Sprayed with Seaweed extract and OHN	0.65^a	0.11	0.76^a	1.52^a
Not sprayed with Seaweed extract and OHN	0.54^b	0.09	0.63^b	1.26^b
Entries (E)				
Betag	0.80^a	0.21^c	1.01^a	2.02^a
CGP 34	0.41^b	0.05^a	0.46^c	0.92^c
CGP 59	0.47^b	0.11^b	0.58^b	1.16^b
CGP 11	0.49^b	0.07^a	0.56^b	1.12^b
CGP 151	0.79^a	0.16^b	0.95^a	1.90^a
(FxE)	ns	ns	ns	
CV_a (%)	11.90	29.55	15.16	
CV_b (%)	13.55	26.43	14.45	

Means with the same letter are not significantly different at 5% level of significance using DMRT.

Total and Computed Yield

Effect of seaweed extract and OHN. Significant differences were noted on the total yield of the plants (Table 10). Garden pea entries sprayed with Seaweed extract and OHN significantly had a higher total yield per plot and computed yield compared to garden pea entries not sprayed with seaweed extract and OHN.

Effect of entry. There were significant differences among the garden pea entries on total and computed yield. Betag and CGP 151 entries significantly exhibited the highest yield followed by CGP 59 and CGP 11. Entry CGP 34 significantly showed the lowest yield.

Interaction effect. No significant interaction effect observed on the garden pea entries and spraying of seaweed extract and OHN on the yield of garden pea.

Reaction to Leaf Miner

It was observed that all the garden pea entries sprayed with seaweed extract and OHN were mildly tolerant to leaf miner (Figure 7).

Reaction to Powdery Mildew

Effect of seaweed extract and OHN. The plants sprayed and not sprayed with seaweed extract and OHN were mild to moderately resistant to powdery mildew at 45 and 70 DAP.

Effect of entry. All the entries were mildly resistant to powdery mildew at 45 DAP. Betag, CGP 11 and CGP 151 were moderately resistant to powdery mildew at 60 DAP while CGP 34 and CGP 59 were moderately susceptible to powdery mildew (Figure 7).

Table 11. Reaction to leaf miner and powdery mildew of the five garden pea entries sprayed with seaweed extract and OHN

TREATMENT	REACTION TO		
	LEAF MINER (45 DAP)	POWDERY MILDEW (45 DAP)	(60 DAP)
Seaweed extract and OHN (F)			
Sprayed with Seaweed extract and OHN	2	2	3
Not sprayed with Seaweed extract and OHN	2	2	3
Entries (E)			
Betag	2	2	3
CGP 34	2	2	4
CGP 59	2	2	4
CGP 11	2	2	3
CGP 151	2	2	3

Rating scale for leaf miner: 1- highly tolerant; 2- mildly tolerant; 3- moderately tolerant; 4- moderately susceptible; 5- very susceptible

Rating scale for powdery mildew: 1- highly resistant; 2- mildly resistant; 3- moderately resistant; 4- moderately susceptible; 5- very susceptible

a b

Figure 7. Leaf miner infestation at 45 DAP (a) and Powdery mildew infection at 60 DAP (b)

Return on Cash Expenses (ROCE)

The return on cash expenses of garden pea entries sprayed and not sprayed with seaweed extract and OHN is shown in Table 12. Garden pea entries not sprayed with seaweed extract and OHN showed positive return on cash expenses. Betag and CGP 151 entries have the highest ROCE while CGP 34 had the lowest ROCE.

Table 12. Return on Cash Expenses (ROCE) of five garden pea entries sprayed with Seaweed extract and OHN

TREATMENT	MARKETABLE PODS ($kg/15m^2$)	GROSS SALE[1] (PhP)	TOTAL EXPENSES[2] (PhP)	NET INCOME (PhP)	ROCE (%)
Sprayed with Seaweed extract and OHN					
Betag	2.52	403.2	565.33	-162.13	-28.68
CGP 34	1.44	230.4	565.33	-334.93	-59.25
CGP 59	1.64	262.4	565.33	-302.93	-53.58
CGP 11	1.77	283.2	565.33	-282.13	-49.91
CGP 151	2.45	392.0	565.33	-173.33	-30.66
Mean					-44.42
Not sprayed with Seaweed extract and OHN					
Betag	2.30	368.0	105.33	262.67	249.38
CGP 34	1.05	168.0	105.33	62.67	59.50
CGP 59	1.21	193.6	105.33	88.27	83.80
CGP 11	1.19	190.4	105.33	85.07	80.77
CGP 151	2.28	364.8	105.33	259.47	246.34
Mean					143.96

[1] garden pea was sold at a price of 160 PhP per kilo.

[2] total expenses include labor cost, seeds, chicken manure, trellis, Seaweed extract and OHN.

All the entries sprayed with Seaweed extract and OHN realized a negative ROCE which is due to the high cost of Seaweed extract and OHN.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted to evaluate the growth and yield of garden pea entries sprayed with Seaweed extract and OHN; determine the effect of spraying Seaweed extract and OHN on the growth and yield of garden pea; determine the interaction effect of spraying seaweed extract and OHN and garden pea entries; and determine the profitability of garden pea production sprayed with Seaweed extract and OHN.

There were significant differences observed among plants sprayed with Seaweed extract and OHN except percent survival, leaflet character, initial plant height, number of nodes per plant, flower and pod characters, non-marketable pods, and reaction to pest and diseases.

There were significant differences observed among the entries of garden pea. CGP 151 produced the longest leaflet followed by CGP 34. CGP 34 was significantly the tallest among the entries. Betag and CGP 34 have the highest number of nodes per plant while CGP 59, CGP 11 and CGP 151 produced the least number of nodes per plant. Betag produced the longer and wider pods. On the other hand, CGP 151 and Betag have the highest weight of marketable pods and total yield per plot. CGP 34 and CGP 59 are moderately susceptible to powdery mildew.

No significant interaction effect of seaweed extract and OHN and garden pea entries was observed in all the parameters gathered.

All the entries sprayed with Seaweed extract and OHN have a negative ROCE due to high cost of fertilizer.

Conclusions

Based on the results of the study, CGP 151 and Betag are moderately resistant to powdery mildew and have the highest weight of marketable pods and total yield. Application of Seaweed extract and OHN increased plant height, marketable yield and total yield.

There is no interaction effect of garden pea entries and spraying seaweed extract and OHN on the growth and yield of garden pea.

Application of Seaweed extract and OHN on garden pea production is not profitable.

Recommendations

Based on the findings, spraying of Seaweed extract and OHN is not recommended for garden pea production.

In terms of yield and profitability, Betag and CGP 151 are recommended.

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