BIBLIOGRAPHY

LUMADAY, JULIMAR D. APRIL 2012. Growth and Yield of Garden Pea Entries as Affected by Intercropping Under Organic Production in La Trinidad, Benguet. Benguet State University, La Trinidad Benguet.

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ABSTRACT

The study was conducted to: determine the effect of intercropping on the growth and yield of garden pea entries and the best garden pea entry that will respond to intercropping under organic production; to compare the growth and yield of garden pea entries grown with marigold and onions; to determine the interaction effect of intercropping and garden pea entries under organic production; and to determine the profitability of growing garden pea entries intercropped with marigold and onion under organic production.

Cropping system significantly affected the number and weight of marketable fresh pods and total yield. High return on cash expense (ROCE) was obtained in garden pea intercropped with onion. Among the entries, CGP 34 produced the highest number and weight of marketable fresh pods and total yield and the most resistant to powdery mildew. The interaction of garden pea entries and cropping system significantly affected the number and weight of marketable fresh pods and total yield. Monocropping with CGP 34 is the best combination to obtain high ROCE.

Under organic production in La Trinidad, garden pea intercrop with onion is recommended. CGP 34 grown either as monocropped or intercropped with onion is recommended.

INTRODUCTION

Garden pea (*Pisum sativum L.*) is one of the leading vegetable crops in Benguet. The production of this crop is feasible under Benguet conditions. Being a high value crop, it gives high income to farmers. Garden pea is grown from fresh pods. Nutritionally, a matured garden pea seed contains high percentage of digestible protein, carbohydrates and important minerals while fresh pods are rich in Vitamin A. However, limited supply could be attributed to low production per area (Swaider and Ware, 2002).

At present, garden pea production is still short demand, which is attributed by various factors such as rapid multiplication of major insect pests. Severe damage of the crop accounts for the lower yield as well as the quality of the pods. One of the solutions to low yield is the use of resistant varieties. These varieties, however, should be adapted to alternative management system or organic production.

Organic farming is a system which avoids the use of any chemical or genetically modified inputs, in which the biological potential of the soil, organic sources and underground water resources are conserved and protected by adopting suitable cropping pattern and methods of organic replenishment. Organic foods prevent people from ingesting regular amounts of pesticides commonly found in commercial products. It ensures that biodiversity remains available in the foods people eat and wildlife that live on the farms. Influence of organic farming is especially favorable for weeds, insects, birds, wildlife, soil flora as well as fauna. Ecofriendly weed control measures provide livelihood rights to many untargeted plants (Deshmukh, 2010).

REVIEW OF LITERATURE

Intercropping in Organic Production

Intercropping can be adopted for organic farming systems as a practical alternative to existing mainly sole-cropping strategies. Intercropping perspective in arable systems and the potential area for intercrops in organic farming is large considering the possible economic benefits and future legal requirement in feed and food industry. Re-introducing intercropping in organic agriculture to a greater extent should not be reversion to old methodology, but rather considering the usefulness of this old and sustainable cropping practice in a modern, innovative and technology-oriented organic agriculture. Furthermore, intercropping constitutes a concrete means to increase the diversification of agricultural ecosystems, for which there is a worldwide appeal (Agricultural Research Institute, 2006).

It has been scheduled that the entire animal feed sources in organic farming should be of organic origin from 2005 in the EU (EU Commission, 1999). This will require a major increase in organic cereal and grain legume (protein) crop production, to balance the worldwide organic deficits. As an example, the French deficit for organic feed protein, considering complete organic feed supply, was 9000 tons in 1999. Intercropping is of special relevance and importance in future organic farming systems, because it offers a number of significant enhancements of both the net productivity of organic farming and the ecosystems in farming regions as a result of the increased diversity of the cropping system. For organic sector, intercropping is considered an effective means of self regulation and resilience of the organic agro.

MATERIALS AND METHODS

Land Preparation and Lay-out

An area of 225 m^2 was used. The study was laid-out using split-plot design with three replications.

The treatments were as follows:

Main crop: Cropping System (CS)	Subplot: Garden pea Entries (E)
CS_1= Garden pea	E_1= Betag
CS_2= Garden pea + Marigold	E_2= CGP 59
CS_3= Garden pea + Onion	E_3= CGP 34
	E_4= CGP 13
	E_5= Chinese

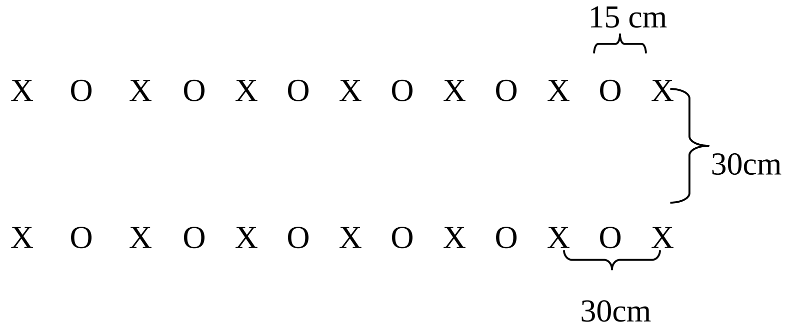
Planting Distance and Compost Application

The distance of planting were 30 cm. between rows and hills, at two seeds per hill. Marigold and green onion was planted in between hills of garden pea as shown in the diagram:

Legend:

X= garden pea   O= Marigold/Green onion

Illustration:



BSU growers compost at a rate of 2.5 kg/plot was mixed thoroughly with the soil a week before planting.

Cultural Management Practices

Cultural practices such as hilling up, weeding and irrigation were uniformly done in all the treatments. Trellising was done one month after planting.

The data gathered were:

1. Agro-climatic data. Minimum and maximum air temperature, percent relative humidity, daily sunshine duration (minutes) and rainfall (millimeter) were taken from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) Agronomical Meteorological Station based at Benguet State University.

2. Maturity

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

b. Number of days from emergence to first flowering. This was recorded by counting the days from emergence to first flowers.

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

d. Number of days from pod setting to pod maturity. This was recorded by counting the days from pod setting to pod maturity.

e. Number of days from flowering to first harvest. This was recorded by counting the days from flowering to first harvest or when seed zones were evident on the pods.

f. Number of days from emergence to first harvesting. This was recorded by counting the days from emergence to first harvesting of fresh pods.

g. Number of days from emergence to last harvesting. This was recorded by counting the days from flowering to last harvesting.

3. Flower characters

a. Number of clusters per plant. This was recorded by counting the flower clusters per plant on ten sample plants per treatment per replication 50 DAP.

4. Pod characters

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

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

c. Number of pods per cluster. This was recorded by counting the nodes bearing the first pod clusters in five sample plants per treatment.

d. Percent pod set per plant. This was computed using the formula:

$$\text{Pod Set (\%)} = \frac{\text{Total Number of Pods per Plant}}{\text{Total Number of Flowers per Plant}} \times 100$$

5. Plant Height (cm)

a. Height at 30 DAP. This was recorded by measuring the height of ten sample plants taken at random per treatment using a meter stick.

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

6. Yield and yield components

a. Number and weight of marketable fresh pods per plot ($kg/5m^2$). This was recorded by counting and weighing the marketable pods per plot from first to the last harvest. Considered as marketable pods were straight pods, smooth, and free from damage.

b. Number and weight of non-marketable pods per plot ($kg/5m^2$). This was recorded by counting and weighing the non-marketable pods per plot per treatment. These were the pods that were over-matured, malformed and damaged by insect pests and diseases.

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

d. Computed pod yield (tons/ha). This was recorded by multiplying the total yield per plot in $kg/5m^2$ x 2.0, where 2.0 is the factor used to convert yield per plot ($kg/5m^2$) in ton/ha assuming one hectare effective area.

7. Reaction to powdery mildew. This was gathered using the following scale used by Tandang *et al*. (2008):

Scale	Description	Remarks
1	No damage/infection	Highly resistant
2	1-25% infections	Mildly resistant
3	26-50% infections	Resistant
4	51-75% infections	Moderately Susceptible
5	76-100% infections	Very susceptible

8. Reaction to aphids infestation. This was determined using the following scale (CIP, 2001):

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

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

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

Analysis of Data

All quantitative data were analyzed using the Analysis of Variance (ANOVA) for Split- plot design with three replications. The significance among treatments means was tested using Duncan's Multiple Range (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Agro-climatic Data

Table 1 shows the temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study. The monthly mean temperature ranged from 14˚C to 25˚C. Air temperature in January was higher than the other months of growing season. The relative humidity was 84 % in January while in December, 87 % relative humidity was noted. Rainfall was high during the month of December and low during the month of January and November. The sunshine duration was high during the month of January.

Buena (2004) found out that the best planting time for garden pea was in the month of November when sufficient moisture favors germination. Garden pea grows best in areas with 10˚-25˚C and with a relative humidity ranging from 75 to 87%.

Table 1. Temperature, relative humidity, amount of rainfall and sunshine duration during the conduct of the study.

MONTHS	TEMPERATURE ˚C MAX	MIN	RELATIVE HUMIDITY (%)	RAINFALL AMOUNT (mm)	DAILY SUNSHINE DURATION (min)
November	24	15	86	2.20	257
December	17	14	87	6.40	244
January	25	14	84	3.20	340
February	22	14	86	3.40	293
Mean	26	14	86	4.00	284

Source: PAG-ASA Office, BSU, La Trinidad, Benguet

Days to Emergence

Effect of Cropping System. Cropping system did not show any significant effect on the number of days from sowing to emergence. Monocrop and garden pea intercropped with marigold and onion emerged seven days after sowing.

Effect of Entry. No significance differences were observed among the five entries of garden pea on the number of days from sowing to emergence.

Interaction Effect. Interaction was not significant between the cropping system and garden pea entries on the number of days from sowing to emergence.

Days from Emergence to First Flowering

Effect of Cropping System. There was no significant difference observed on cropping system on the number of days from emergence to first flowering (Table 2).

Effect of Entry. There were highly significant differences on the number of days from emergence to first flowering among the garden pea entries. CGP 13 and Betag were the earliest to flower while CGP 34 was the latest to bear flowers. This signifies that garden pea entries have different characteristics relative to flowering.

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries on days from emergence to first flowering.

Days from Emergence to First Harvesting

Effect of Cropping System. As shown in Table 2, cropping system has no significant effect on the number of days from emergence to first harvesting.

Table 2. Number of days from emergence to first flowering and last flowering of garden pea entries as affected by cropping system

TREATMENT	NUMBER OF DAYS	
	EMERGENCE TO FIRST FLOWERING	EMERGENCE TO FIRST HARVESTING
Cropping System (CS)		
Monocrop	35	50
Garden Pea + Marigold	35	50
Garden Pea + Onion	34	50
Entries (E)		
Betag	36^{b}	44^{a}
CGP 59	29^{a}	50^{b}
CGP 34	43^{c}	54^{c}
CGP 13	29^{a}	45^{a}
Chinese	36^{b}	54^{c}
CS x E	ns	ns
CV_a (%)	0.86	5.23
CV_b (%)	2.46	4.00

*Means with common letters are not significantly different at 5% level of DMRT.

Effect of Entry. There were highly significant differences observed among the garden pea entries on the number of days from emergence to first harvesting (Table 2). CGP 13 and Betag were the earliest to be harvested. CGP 34 and Chinese were the latest to be harvested. The variations on the number of days to first harvesting among entries could be attributed to varietal differences.

Interaction Effect. No significant interaction between cropping system and garden pea entries was shown on days to harvest. CGP 13 intercropped with marigold and garden pea as monocrop were earliest to harvest than those plants intercropped with onion.

Days from Flowering to Pod Setting and Pod Setting to Pod Maturity

Effect of Cropping System. There was no significant difference on the cropping system as shown in Table 3. All plants regardless of system took seven days from flowering to pod setting.

Effect of Entry. Betag was the earliest on pod setting while Chinese and CGP 59 were the latest set pods. CGP 59 was the earliest to mature followed by Betag. Chinese and CGP 13 had comparable pod maturities while CGP 34 was the latest pod mature. This corroborates with the result of Gawidan (2006), which revealed that Betag set pod earlier than other garden pea entries.

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries on days from flowering to pod setting and pod setting to pod maturity.

Table 3. Number of days from flowering to pod setting and pod setting to pod maturity of garden pea entries as affected by cropping system

TREATMENT	NUMBER OF DAYS	
	FLOWERING TO POD SETTING	POD SETTING TO POD MATURITY
Cropping System (CS)		
Monocrop	7	9
Garden Pea + Marigold	7	9
Garden Pea + Onion	7	9
Entries (E)		
Betag	5[a]	8[b]
CGP 59	8[d]	7[a]
CGP 34	6[b]	9[c]
CGP 13	7[c]	8[b]
Chinese	8[d]	8[b]
CS x E	ns	ns

*Means with common letters are not significantly different at 5% level of DMRT.

Number of Flower Clusters per Plant

Effect of Cropping System. There was no significant difference noted on the number of flower clusters per plant in cropping systems (Table 4).

Effect of Entry. Significant difference was noted among the five garden pea entries on the number of flower clusters per plant (Table 4). CGP 34, Chinese and Betag obtained the highest number of flower clusters per plant. CGP 59 had the least number of flower clusters

Table 4. Number of flower clusters per plant and percent pod set of garden pea entries as affected by cropping system

TREATMENT	NUMBER OF FLOWER CLUSTER PER PLANT	POD SET (%)
Cropping System (CS)		
Monocrop	8	64[b]
Garden Pea + Marigold	8	60[a]
Garden Pea + Onion	8	64[b]
Entries (E)		
Betag	9[a]	60[c]
CGP 59	7[c]	52[e]
CGP 34	9[a]	79[a]
CGP 13	8[b]	57[d]
Chinese	9[a]	66[b]
CS x E	ns	ns
CVa (%)	9.83	3.50
CVb (%)	8.36	13.84

*Means with common letters are not significantly different at 5% level of DMRT.

per plant. The variations on flower clusters per plant observed among entries could be attributed to varietal differences.

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries on flower clusters per plant.

Percent Pod Set per Plant

Effect of Cropping System. There was a significant difference noted on the percent pod set per plant in cropping systems. Monocrop and garden pea intercropped with onion had the highest percent pod set per plant while garden pea intercropped with marigold obtained the least percent pod set per plant. This could be due to the susceptibility of plants to powdery mildew when intercropped with marigold.

Effect of entry. Highly significant differences were noted among garden pea entries in terms of percent pod set per plant (Table 4). CGP 34 was the highest to set pods and CGP 59 has the least percent pod set per plant. There are factors that affect the development of flowers and pods such as; pests and diseases, nutrients and water availability. Although, pod set is also controlled by its genetic components (Laegreid, 1999).

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries on percent pod set per plant.

Number of Pods per Cluster

Effect of Cropping System. There was no significant difference on the number of pods produced per plant in cropping system.

Effect of Entry. Entry CGP 13, CGP 34 and Chinese obtained the highest number of pods produced per plant while CGP 59 obtained the lowest pods produced per plant.

This result corroborates with the result of Ossog (2010), which revealed that Chinese and CGP 13 set pod earlier than the other entries evaluated.

Interaction Effect. There was no significant interaction between the cropping systems and garden pea entries on number of pods per plant.

Height at 30 DAP and at Maturity

Effect of Cropping System. There was a significant difference noted on height of plant at 30 DAP and height at 75 DAP in cropping system. Garden pea as monocrop had the tallest plants at 30 DAP and at 75 DAP. The differences may be due to the competition of plants for water availability and nutrients.

Effect of Entry. There were highly significant differences among garden pea entries on the height at 30 DAP and at 75 DAP. CGP 34 was the tallest at 30 DAP and at 75 DAP. Betag, CGP 13 and CGP 59 had comparable heights. These results were similar with the result of Gawidan (2006) where CGP 34 was the tallest among the garden pea evaluated. The differences may also due to the different genetic make-up of the garden pea entries.

Interaction Effect. No significant interaction was observed between cropping systems and garden pea entries in terms of height at 30 DAP and height at 75 DAP of garden pea.

Table 5. Plant height of garden pea entries at 30 and 75 DAP as affected by cropping system

TREATMENT	PLANT HEIGHT (cm)	
	HEIGHT AT 30 DAP	HEIGHT AT MATURITY
Cropping System (CS)		
Monocrop	42[a]	147[a]
Garden Pea + Marigold	40[b]	145[b]
Garden Pea + Onion	39[b]	144[b]
Entries (E)		
Betag	39[c]	144[c]
CGP 59	39[c]	130[d]
CGP 34	43[a]	166[a]
CGP 13	39[c]	130[d]
Chinese	41[b]	157[b]
CS x E	ns	ns
CVa (%)	1.44	0.02
CVb (%)	1.49	0.04

*Means with common letters are not significantly different at 5% level of DMRT.

Reaction to Powdery Mildew

Effect of Cropping System. The three cropping systems had moderately susceptible plants to powdery mildew (Table 6).

Effect of Entry. CGP 34 and Chinese were observed to be the most resistant among the garden pea entries while CGP 59, CGP 13 and Betag were moderately susceptible to powdery mildew. These similar results were also obtained by Ossog (2010), which showed that Chinese and CGP 34 were resistant to powdery mildew. Laegreid (1999) stated that the plant genetic characteristics such as yields, resistance to pest and diseases and the adaptation to stresses are best to be considered in the production of crops.

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries on their response to powdery mildew infection.

Reaction to Aphids

Effect of Cropping System. No significant difference on the different cropping systems on the reaction to aphids infestation (Table 7).

Effect of Entry. It was observed that entries CGP 34, Chinese and Betag were resistant to aphids infestation while entries CGP 13 and CGP 59 were moderately susceptible to aphid infestation (Table 7). This can be attributed to varietal characteristics. It was observed that CGP 34, Chinese and Betag had hard stems as compared with the other entries.

Interaction Effect. No significant interaction between the cropping systems and garden pea entries on the reaction to aphids infestation was shown.

Table 6. Reaction to powdery mildew of garden pea entries as affected by cropping system at 73 DAP

TREATMENT	RATING	DESCRIPTION
Cropping System (CS)		
Monocrop	4	Moderately Susceptible
Garden Pea + Marigold	4	Moderately Susceptible
Garden Pea + Onion	4	Moderately Susceptible
Entries (E)		
CGP 59	4^{b}	Moderately Susceptible
Betag	4^{b}	Moderately Susceptible
Chinese	3^{a}	Resistant
CGP 13	4^{b}	Moderately Susceptible
CGP 34	3^{a}	Resistant
CS x E	ns	

*Means with common letters are not significantly different at 5% level of DMRT.

Table 7. Reaction of garden pea entries to aphid infestation as affected by cropping system

TREATMENT	RATING	DESCRIPTION
Cropping System (CS)		
Monocrop	4	Moderately Susceptible
Garden Pea + Marigold	4	Moderately Susceptible
Garden Pea + Onion	4	Moderately Susceptible
Entries (E)		
CGP 59	4[a]	Moderately Susceptible
Betag	3[a]	Resistant
Chinese	3[b]	Resistant
CGP 13	4[b]	Moderately Susceptible
CGP 34	3[a]	Resistant
CS x E	ns	

*Means with common letters are not significantly different at 5% level of DMRT.

Pod Length

Effect of Cropping System. No significant difference was noted on the pod length on cropping system. Garden pea as monocrop has the longest pods among the cropping systems.

Effect of Entry. There was highly significant difference noted among the entries on their pod length. CGP 13 has the longest pods while Chinese had the shortest pods among garden pea entries (Table 8). This can be attributed to the inherent characteristics of the garden pea entries.

Interaction Effect. No significant interaction between cropping systems and garden pea entries on pod length.

Table 8. Pod length and width of garden pea entries as affected by cropping system

TREATMENT	POD	
	LENGTH (cm)	WIDTH (cm)
Cropping System (CS)		
Monocrop	6.70	1.30
Garden Pea + Marigold	6.69	1.29
Garden Pea + Onion	6.69	1.29
Entries (E)		
Betag	6.90[b]	1.32[b]
CGP 59	6.70[b]	1.31[b]
CGP 34	6.90[b]	1.32[b]
CGP 13	7.50[a]	1.40[a]
	6.20[c]	1.18[c]
Chinese		
CS x E	ns	ns
CVa (%)	0.68	1.61
CVb (%)	0.91	0.41

*Means with common letters are not significantly different at 5% level of DMRT

Pod Width

Effect of Cropping System. There was no significant difference noted on the width of the pods as affected by garden pea intercrop with marigold and onion and garden pea alone (Table 8).

Effect of Entry. Highly significant difference on pod width among garden pea entries (Table 8). CGP 59 had the widest pods while the narrowest pods were measured on Chinese. This may due to genetic characteristics of the different garden pea entries. (Laegreid, 1999).

Interaction Effect. There was no significant interaction between cropping systems and garden pea entries noted on pod width.

Number of Marketable Fresh Pods

Effect of Cropping System. There was a significant difference on the number of marketable fresh pods in the different cropping system as shown in Table 9. Garden pea as monocrop produced the highest number of marketable fresh pods followed by garden pea intercropped with onion while garden pea intercropped with marigold had the least marketable pods.

Effect of Entry. There were highly significant differences on the number of marketable fresh pods among garden pea entries (Table 9). CGP 34 produced the highest number of marketable fresh pods while CGP 59 produced the least number of marketable fresh pods. Variations on the number of marketable fresh pods observed among entries could be attributed to varietal differences.

Interaction Effect. The interaction between the cropping system and garden pea entries were highly significant on the number of marketable fresh pods. CGP 34 monocrop has the highest number of fresh pods followed by CGP 34 intercropped with onion and CGP 34 intercropped with marigold has the least number of marketable fresh pods (Figure 1).

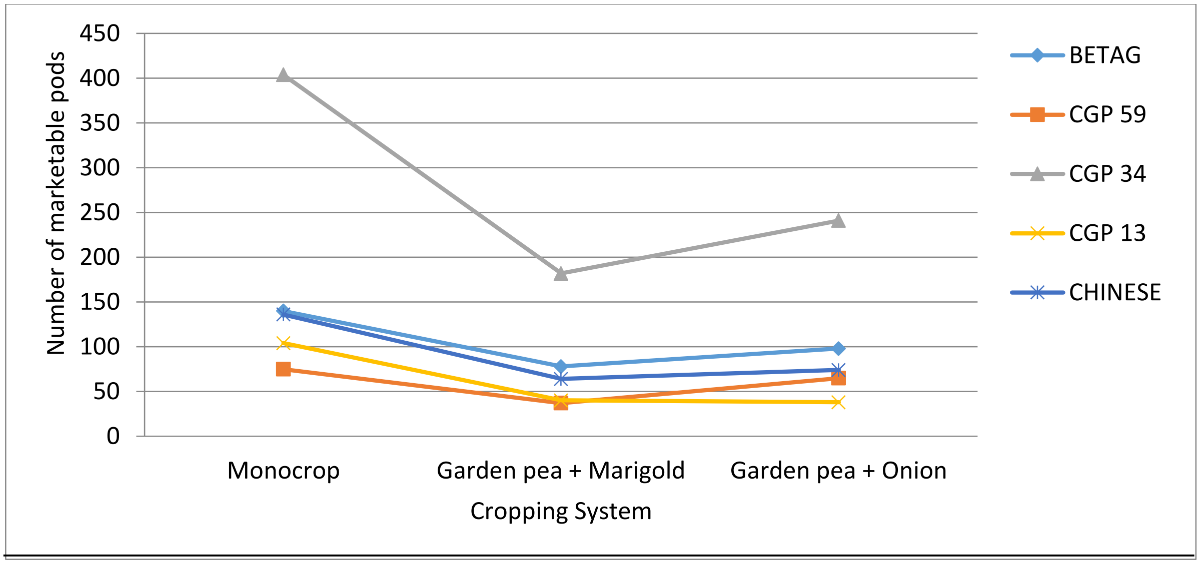


Figure 1. Interaction effect between cropping system and garden pea entries on the number of marketable fresh pods

Number of Non-Marketable Fresh Pods

Effect of cropping system. Cropping system did not significantly affect the number of non- marketable fresh pods (Table 9).

Effect of Entry. There were highly significant differences on the number of non-marketable fresh pods among garden pea entries (Table 9). CGP 59 produced the least number of non-marketable fresh pods while 34 produced the most number of non-marketable fresh pods.

Interaction Effect. No significant interaction between cropping systems and garden pea entries on the number of non-marketable fresh pods was noted.

Weight of Marketable Pods

Effect of Cropping System. There was a significant difference noted on the weight of the marketable fresh pods harvested as a result of monocrop and garden pea intercropped with marigold and onion (Table 10). Garden pea as monocrop produced the highest marketable fresh pods. This may be attributed to the high number of pods harvested per plant. Intercropping garden pea with marigold and onion resulted in least number of marketable fresh pods. the intercropping practice may have encourage competition for sunlight and nutrients among plants.. Competition effect is most pronounced in intercropping, since plants compete not only for sunshine and carbon dioxide in the air but also for water and nutrients (Gomez and Gomez, 1983).

Effect of Entry. Entry CGP 34 produced the highest marketable yield while CGP 13 produced the lowest marketable fresh pods among the garden pea entries (Table 10). The high yield of CGP 34 might be attributed to resistance to powdery mildew infection and aphids infestation. It was observed that CGP 34 and Chinese were the least infected with powdery mildew and aphids. CGP 13 on the other hand was susceptible to powdery mildew and aphids infestation. As observed, garden pea entries vary on their pod width and length. For instance, CGP 34 had the longest and broadest pods which may have contributed to heavy pods.

Table 9. Number of marketable and non- marketable pod of garden pea entries affected by cropping system

TREATMENT	NUMBER	
	MARKETABLE POD	NON-MARKETABLE POD
Cropping System (CS)		
Monocrop	172[a]	39
Garden Pea + Marigold	80[c]	40
Garden Pea + Onion	103[b]	40
Entries (E)		
CGP 59	59[d]	34_a
Betag	91[c]	46[b]
Chinese	105[b]	48[c]
CGP 13	61[d]	46[b]
CGP 34	276[a]	69[d]
CS x E	*	ns
CV_a (%)	12.95	14.99
CV_b (%)	9.80	13.63

*Means with common letters are not significantly different at 5% level of DMRT.

Interaction Effect. There was a significant interaction between the cropping systems and garden pea entries on weight of marketable fresh pods. Entry CGP 34 as monocrop had the highest weight marketable fresh pods (Figure 2). Highest weight of marketable pods harvested may indicate high number of marketable fresh pods.

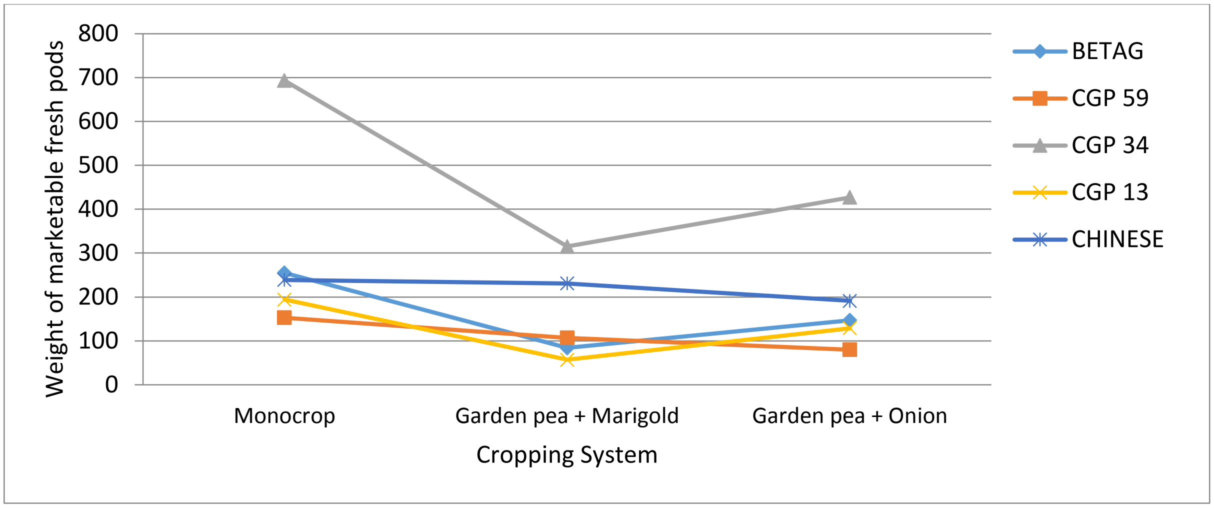


Figure 2. Interaction effect of cropping system and garden pea entries on weight of marketable pods

Weight of Non-Marketable Fresh Pods

Effect of Cropping System. Cropping system has a significant difference on weight of non-marketable fresh pods (Table 10). Garden pea as monocrop had the highest weight of non-marketable fresh pods. This may be attributed to the high number of pods harvested per plant of garden pea entries.

Effect of Entry. Highly significant differences were noted among garden pea entries on weight of non-marketable fresh pods. Betag had the highest weight of non-marketable pods harvested.

Interaction Effect. There was no significant interaction between cropping systems and different garden pea entries on weight of non-marketable fresh pods (Table 10).

Table 10. Weight of marketable and non-marketable fresh pods of garden pea entries as affected by cropping system

TREATMENT	WEIGHT	
	MARKETABLE POD (g/5m^2)	NON-MARKETABLE POD (g/5m^2)
<u>Cropping System (CS)</u>		
Monocrop	307^{a}	131^{c}
Garden Pea + Marigold	160^{c}	82^{a}
Garden Pea + Onion	206^{b}	100^{b}
<u>Entries (E)</u>		
Betag	157^{c}	55^{a}
CGP 59	130^{d}	64^{b}
CGP 34	480^{a}	124^{e}
CGP 13	129^{d}	96^{d}
Chinese	226^{b}	73^{c}
CS x E	*	ns
CVa	14.56	8.24
CVb	11.28	5.34

*Means with common letters are not significantly different at 5% level of DMRT.

Total and Computed Yield

Effect of Cropping System. There were significant differences on the total and computed yield among the cropping systems (Table 11). Garden pea as monocrop had the highest total and computed yield. The lowest yield was obtained in garden pea with marigold. Low yield may be attributed to the allelophatic effects of marigold on garden pea plants Koockeki (2008).

Effect of Entry. There were highly significant differences observed among garden pea entries on total and computed yield (Table 11). CGP 34 produced the highest total yield. CGP 34 was noted to produce the most number and heaviest marketable fresh pods. the high yield of CGP 34 could be attributed to its wide and long pods as mentioned in the earlier results.

Interaction Effect. There was a significant interaction observed between cropping systems and garden pea entries in terms of total yield and computed yield (Figures 3 and 4). The highest yield was obtained from CGP 34 as monocrop.

Table 11. Total yield and computed yield per plot of garden pea entries affected by cropping system

TREATMENT	TOTAL YIELD (g/5m²)	COMPUTED YIELD (t/ha)
Cropping System (CS)		
Monocrop	389[a]	1.10[a]
Garden Pea + Marigold	289[c]	0.65[c]
Garden Pea + Onion	306[b]	0.77[b]
Entries (E)		
Betag	238[c]	0.68[b]
CGP 59	238[c]	0.63[b]
CGP 34	610[a]	1.22[a]
CGP 13	235[d]	0.64[b]
Chinese	319[b]	0.84[b]
CS x E	*	*
CV_a	9.64	12.93
CV_b	4.36	12.66

*Means with common letters are not significantly different at 5% level of DMRT.

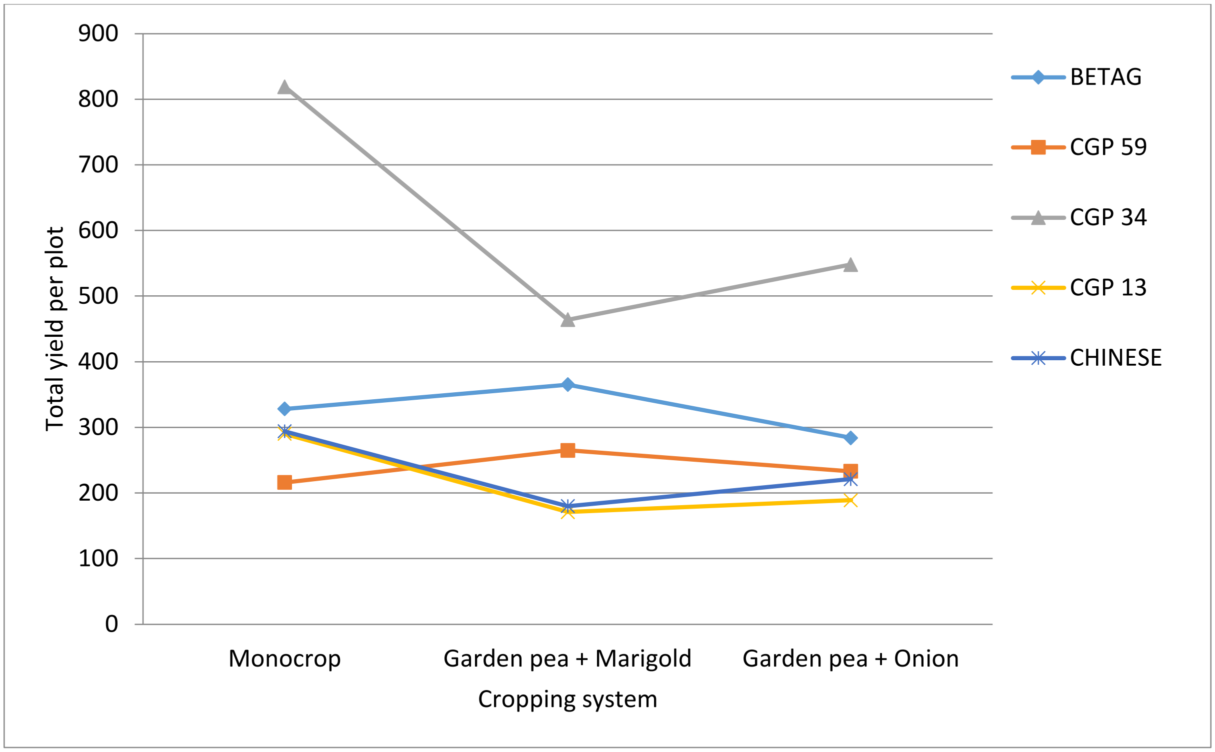


Figure 3. Interaction effect between cropping system and garden pea entries on total yield per plot

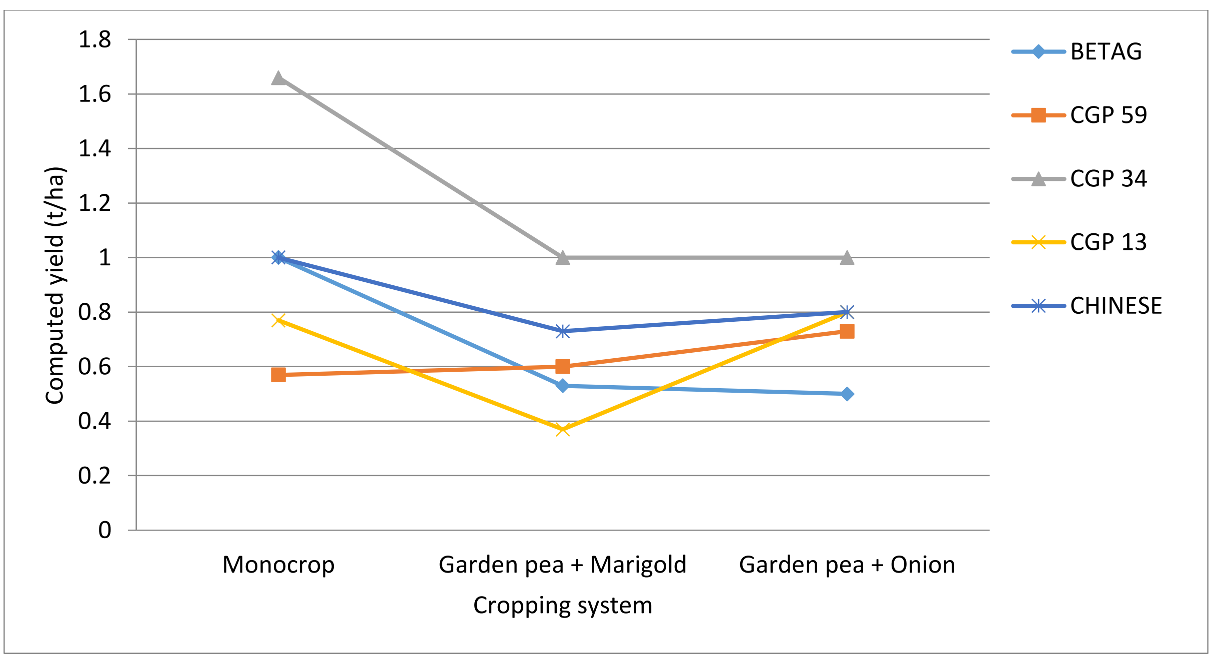


Figure 4. Interaction effect between cropping system and garden pea entries on computed yield (t/ha)

Return on Cash Expenses (ROCE)

Return on cash expense (ROCE) is shown in Table 12. Garden pea entries intercropped with onion had the highest ROCE with 74% while garden pea entries intercropped with marigold had the least return on cash expense of 1 %. Among the entries CGP 34 exhibited the highest ROCE in all cropping systems. The combination of CGP 34 and monocropping, however, had the highest ROCE among the combinations of entry and cropping system.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The effect of cropping system and garden pea entries were studied under organic production. The entries were Betag, CGP 59, CGP 34, CGP 13 and Chinese while cropping systems were monocrop, garden pea with marigold and garden pea with onion.

Findings revealed that the effect of cropping system on some parameters did not differ significantly on number of days from emergence to first flowering, from emergence to first harvesting, from flowering to pod setting, pod setting to pod maturity and the number of flower clusters per plant.

On yield parameters, significant differences on the number and weight of marketable fresh pods, total yield per plot and the computed yield of garden pea as affected by cropping system was noted.

For powdery mildew and aphid resistance, cropping system had no significant influence. In terms of ROCE garden pea intercropped with onion obtained the highest return on cash expense among the cropping systems.

The different garden pea entries significantly different on plant characters such as maturity, number of flower clusters per plant, height, powdery mildew and aphid resistance, number and weight of marketable pods, total and computed yield. CGP 34 was the best performer in terms of marketable fresh pods and resistance to powdery mildew. Chinese ranked second in terms of yield and was also resistant to powdery mildew.

The interaction of garden pea entries and cropping system was not significant in most of the parameters. Significant interaction, however, between cropping system and garden pea entries was noted the number and weight of marketable fresh pods and total

LITERATURE CITED

AGRICULTURAL RESEARCH INSTITUTE (ARI). 2006. Organic farming and Intercropping: Agricultural Research Institute (ARI), Taichung, Taiwan ROC Retrieved on August 29, 2011 from <http://www.intercrop.dk/General.htm>

ANNOGUE, W.D. 1997. Evaluation and Correlation Analysis of Eleven Garden Pea Entries. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 2.

BASING-AT, L.W. 2004. Growth and Yield of Mungbean Entries Intercropped with Corn under La Trinidad, Benguet Condition. BS Thesis. Benguet State University, La Trinidad, Benguet

BATANGAS, H.A., 2002. Effects of different tillage practices on corn intercropped with sweet potato. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 28.

BUENA, C.B. 2004. Seed production of garden pea applied with dolomite and coconut coir dust. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 14.

INTERNATIONAL POTATO CENTER (CIP). 2001. Compiled data sheet (loose sheet).

DESHMUKH, S. N. 2010. Organic Farming: principles, prospects and problems Agrobios India publisher: Agro house, Nasarani Cinema. Pp. 1-19.

DOLIQUE, V.B. 1982. The Effect of Intercropping Snap Bush Bean in the Growth and Yield of Garden Pea under Different Plot Orientation. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 28.

GAWIDAN, L.P. 2006. Fresh pod and Seed Yield of Garden pea entries in La Trinidad Benguet. BS Thesis. Benguet State University, La Trinidad, Benguet. P. 8.

GOMEZ, A.A. and A.K. GOMEZ. 1983. Multiple Cropping in the Humid Tropics of Asia. International Development Research Center. Ottawa, Canada. P. 50

HIGHLAND AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT CONSORTIUM (HARRDEC). 2006. Traditional Farming system in Benguet. Department of Agriculture. Philippines. P 12.

HYNES, D.V. and R. C. ERIN. 2008. "Organic Farming." Accessed at Microsoft Encarta Student 2009[DVD] Redmond. WA: Microsoft Corporation.