BIBLIOGRAPHY

PALAROAN, GINALYN U. APRIL 2006. Agronomic Characters of Potato Entries Applied with Organic Fertilizers Under La Trinidad, Benguet Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted at the BSU Experimental area and aimed to: determine the best performing potato entry applied with organic fertilizer; determine the kind of organic fertilizer that will produce plants with high yield under La Trinidad, Benguet condition; determine the best combination of potato entry and organic fertilizer that will effect high yield and resistance to insects and diseases; and determine the economics of potato production using different entries and organic fertilizers.

Only entries 676070 and 5.19.2.2 were highly vigorous at 45 DAP. Plants applied with BSU compost were more vigorous than those plants applied with sunflower compost and not applied with any organic fertilizer.

As to resistance to late blight, entry 5.19.2.2 was observed to be the most resistant among the ten entries. The application of BSU compost and sunflower may have contributed to the resistance of the potato plants. Different result was obtained for resistance to leafminer. Most of the potato entries were resistant except for entries 676070 and 285411.2 which were moderately resistant. Plants applied with BSU compost have intermediate resistance to leafminer.

Based on marketable yield, entry 676089 produced the highest. Plants applied with BSU compost produced the highest marketable yield.

The dry matter content (DMC) of tubers significantly varied among the entries. All entries however, had more than 18 % [illegible]C of tubers, a characteristic for processing potato. Entry 5.19.2.2 displayed the highest DMC. Plants applied with BSU compost and sunflower and plants not applied with any inorganic fertilizer had similar DMC.

The cost and return analysis shows that seed tuber production is more profitable than table potato production using the different potato entries applied with organic fertilizers.

Further, it was shown that non-application of organic fertilizer is more profitable that applying compost. Entry 606089 not applied with any organic fertilizers registered the highest return on cash expense.

Based on the results, entry 676089 could be recommended for organic potato production under La Trinidad, Benguet condition. Non-application of organic fertilizer is possible for potato production under La Trinidad, Benguet condition.

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INTRODUCTION

In the Philippines, potato is a high priority crop because of its potential yield and nutritional value. Potato is a rich source of carbohydrates, protein and other vitamins and minerals. It is mainly cultivated in Benguet and some parts of Mountain Province, where currently some 5,000 hectares are devoted to the crop (Batt, 1999).

Potato production is a profitable venture in the Philippine highlands. This is because it is very much adapted under temperate climate and has a high market value. Potato requires a high capital due to the increasing price of pesticides and fertilizers, thus production is not sustainable. To have sustained production, search for an alternative practice that could reduce the use of pesticides and chemical fertilizers should be done. Chemically produce pesticides and fertilizers are costly and if not managed properly may contribute significantly to environmental pollution (DA, 2003).

Alternative practices such as the use of organic fertilizers may help in supplementing essential nutrients in the soils and not to harm human body as well as to the environment. Compost is commonly used by farmers as a replacement for chemical fertilizers. Another cheap organic fertilizer in the highlands is wild sunflower. Wild sunflower is bountiful in the highlands and commonly used in vegetables and rice paddies (CECAP, 2000). Despite the importance of wild sunflower as organic fertilizer, there are no data available showing its efficiency on potato production.

Compost and wild sunflower are alternative fertilizers to be used in organic farming. Researchers claim that the use of organic fertilizers assures the farmers of lower production costs, and as a fertilizer it ensures vigorous growth of the plant. Organic fertilizer application also helps control soil borne diseases, improve soil properties and helps maintain stable soil nutrients.

One important aspect in organic farming is the selection of varieties that are resistant to pest and diseases and high yielding. Selection of potato entries that possess such characteristics may help increase the organic potato production in the Philippine highlands.

The study was conducted to:

1. determine the best performing potato entry applied with organic fertilizers based on yield and resistance to pest and diseases;

2. determine the kind of organic fertilizer that will produced plants with high yield under La Trinidad Benguet condition;

3. determine the best combination of organic fertilizer and potato entry that will give the best performance in terms of yield and resistance to insects and diseases; and

4. determine the economics of potato production using different entries and organic fertilizers.

The study was conducted at the BSU Experimental Station, Balili La Trinidad Benguet from November 2005 to February 2006.

REVIEW OF LITERATURE

Importance of Organic Matter

According to Parnes (1986), organic matter is principally a source of nitrogen, phosphorous and sulfur nutrients when soil organisms require and retain most of the calcium, magnesium and potassium in decaying residues as discarded by the soil organism during the first stages of decomposition and these nutrients are quickly available to plants.

Poincelot (1980) stated that decomposition or organic matter by microorganisms release nutrients, inducing trace elements needed for crop production. While not enough for complete maintenance, it does help to offset fertilizer needs. The organic matter removed after degradation, a stabilized form resistant to microbial attack known as humus.

The specific effect of organic matter upon structure arises from its contribution to the development of soil aggregates. Improvement in soil aggregation result in better root development and lesser amount of energy to work the soil. A direct relationship between organic matter and the population and distribution of beneficial soil biota is also noted. The most productive agricultural soil posses good structure, considerable on exchange capacity and water retention, and high populations of beneficial microorganisms, all depends upon the presence of organic matter (OTA, 1982).

Increased organic matter in the soil can also reduce the loss of soil. An average of 1 % in soil organic matter can decrease the potential of soil erosion by 10 %. Such increase in soil organic matter is possible with continuous organic practices of manure applications and grass-legume potato (Cooke, 1977).

Effect of Organic Fertilizers in Benguet

Based on the study by Galagal (2002) at Sablan on sweetpotatoes, application of hog manure, chicken manure and BSU compost had a significant effect on root yield on the different varieties of sweetpotato. The result implies that application of chicken manure and BSU compost are best in sweetpotato production under Sablan, Benguet condition.

According to Balaoing and Lagman (2003), the use of vermicompost as fertilizer provides necessary nutrients in growing pechay. Also vermicompost is also a good potting media for onions.

Eslao (1996) found that cabbage applied with 12 tons/ha chicken manure plus organic fertilizers under La Trinidad condition produced higher average weight of heads and marketable yield. On the other hand, no significant differences were observed on the solidity of cabbage head as affected by organic fertilization.

In carnation, Andaya (1999) reported that pure BSU compost and BSU compost + garden soil (4:1) proved to be the best growing media for cutflowers. The plants produce more number of flowers, have increased stem length, have improved quality of marketable cut flowers and had the biggest bloom of flowers.

Compost and Sunflower as
Organic Fertilizer

Compost, contains reasonable levels of nitrogen, phosphorous and potassium, silica as well as enough carbon or fibrous material to improve the physical, chemical and biological properties of soil. It is also used to improve soil conditions in various ways. It granulates the soil particles and make it loses for easy tillage, and improves soil drainage aside from being a good source of plant nutrients.

Different composts have varying compositions in a study conducted by Bureau of Soil and Water Management (1994). It was found that mushroom compost can provide necessary nutrient for growing. It contains 17.5 % of organic matter, 5 % of nitrogen, 310 % ppm phosphorous and 365 ppm potassium and pH of 7.2 % (Cuyahon, 1996). According Balaoing (2006), BSU compost contains 5 % of nitrogen, 3 % phosphorous and 2 % potassium. Alnus compost contains 50 % organic matter, 2.5 % nitrogen, 7.0 % phosphorous, 3.36 % potassium and pH of 4.6 % as cited by Mercado (1996). Abadilla (1982) as cited by Baldo (1989)) claimed that the nitrogen content of Azolla varies according to season and entry. Under high temperature growth is fast and nitrogen content is higher than when it is cold which are as follows: 4-5 % nitrogen, 6.5-6.9 % phosphorous, 2.0-2.5 % potassium and with a pH of 7-8 %.

In the absence of manure, wild sunflower can be a perfect starter of compost that hastens decompositions, it also increases the nutrient content of the soil. It s a rich source of nitrogen has high rate of mineralization – the conversion of nitrogen into ammonium and nitrate which are needed by plants. The use of wild sunflower as pure organic fertilizer in rice production proves to be the most effective among the other organic matter as registered the highest yield of about 5 t/ha. Sunflower also provides rice plants with more nitrogen on the tillering stage (Gado, 2006).

Based on the study by Baldo (1989) the initial and final height of potato plants were significantly affected by Azolla and sunflower fertilization. There were no significant differences observed among treatments involving combination of compost (azolla and sunflower). Application of 25 % sunflower + 75 % inorganic fertilizer gave the highest mean height of the potato but application of 100 % sunflower compost resulted to high pH of the soil.

Furthermore, Durante (1982) found that in garden pea, plants applied with 2 and 8 tons of wild sunflower per hectare and control plants registered the highest at harvest, the nitrogen content of the soil increased as the rates of wild sunflower was raised. The application of wild sunflower significantly affected the green pod yield, height of plants and the number and weight of the root nodules of the plants at flowering and harvest.

Evaluation of Potato Varieties Using Organic Fertilizer
Under Philippine Highland Condition

In an study by Pandosen (1980) results show that potato plants not applied with organic matter were stunted compared to the treated ones which are vigorous, thus, organic matter plays a role similar to that of nitrogen with regard to the growth and yield of the plants. The application of nitrogen produced vigorous plants and helped on the tuber formation. Apparently, an increase in the absorption of nitrogen by plants as followed by an increase in leaf area, and its in turn must be followed by an increase in the potassium of carbohydrates are to be made insufficient quantities for normal protein production for the tubers comparable to the amount of nitrogen absorbed.

Further, Toledo (1982) found that application of different rates of organic matter had a highly significant effect on the growth and yield of potatoes. The tallest plants were obtained from the application of 3 cans/pot. Those fertilized with organic matter beyond 3 cans/pot tend to be smaller. In yield, the heaviest mean was obtained from plants treated with 4 cans of organic matter. Beyond this level, tuber yield tend to decrease.

Campiwer (1999) found that different mixtures of organic fertilizers significantly affected the height of the potato plants and the weight of extra large potato tubers, but not on small, big and large tubers. Application and formulation of 6 tons/ha chicken dung, 6 tons/ ha horse manure, 6 tons/ha pig manure and 6 tons/ha fresh sunflower enhanced taller and total yield of potato per plot. It also improved the physical and chemical properties of the soil and proved to be the best combination to enhance the growth and yield of potato.

MATERIALS AND METHODS

Planting Materials

Ten potato entries grown from rooted stem cuttings were acquired from Northern Philippines Root Crops Research and Training Center (NPRCRTC). These entries were selections from an observational trial for organic production at Balili, La Trinidad Benguet in September 2005. These entries were selected by farmers and researchers based on yield and resistance to pests and diseases.

Land Preparation and Application of Organic Fertilizers

The area (450 m^2) have been used for organic production for the last three years. The area was thoroughly prepared and was divided into three blocks. Each block consisted of thirty plots measuring 1 m x 5 m. Figure 1 shows the overview of the farm.

Compost acquired from the Benguet State University was applied at a rate of 5 kg/5 m^2 two weeks before planting.

Wild sunflower was collected within the locality. Stem and leaves were cut into small pieces using a shredder machine. The shredded sunflower materials were applied at 5 kg/5 m^2 one month before planting.

Layout of the Experiment

The study was laid out in 3 X 10 factor factorial arranged in randomized complete block design (RCBD) with three replications. Potato entries, served as Factor A and organic fertilizer as Factor B.

Figure 1. Overview of the experimental area

Factor A: Potato Entries:

ENTRY	SOURCE
IP84007.67	CIP, Peru
676070	CIP, Peru
575003	CIP, Peru
385411.22	CIP, Peru
5.19.2.1	Philippines
573275	CIP, Peru
676089	CIP, Peru
5.19.2.2	Philippines
Kennebec	USA
Ganza	CIP, Peru

Factor B: Organic Fertilizers

T_1 – Control (no organic fertilizer)

T_2 – BSU compost

T_3 – Wild sunflower (*Titonia diversifolia*)

Planting

Potato rooted stem cuttings were planted at a distance of 25 cm between hills and 30 cm between rows.

Cultural Management Practices

Cultural management practices were merely organic that is; synthetic pesticide and fertilizers were not used during the study. Instead, marigold was planted to act as insect repellant. Corn was planted around the area to serve as barrier and encourage diversity. Yellow traps were established in the area to minimize the occurrence of leaf miner. Other cultural management practices such as irrigation and weeding were employed during the study. Botanical fungicide was sprayed at a rate of 6-8 tsp at 60 days after planting (DAP). Hilling-up was done at 30 DAP.

Data gathered were the following:

1. Soil analysis. Soil samples were taken before land preparation and after harvest to determine soil chemical properties such as pH, organic matter, nitrogen, phosphorous and potassium content. Soil samples were brought to the Bureau of Soils Pacdal, Baguio City for analysis.

2. Plant vigor. This was recorded at 30 and 45 DAP using the following scale (CIP, 2000):

SCALE	DESCRIPTION
1	Very poor growth
2	Poor growth
3	Moderately vigorous
4	Vigorous
5	Highly vigorous

3. Late blight incidence. Observation started during the vegetative stage at 45, 60 and 75 DAP using the rating scale by Henfling (1982):

BLIGHT	CIP SCALE[1]	DESCRIPTION OF CORRESPONDING SYMPTOMS
0	1	No blight can be seen.
0.1-1.0	2	Not more than two lesions per 10 m of row +/-30 plants up to small lesions per plant.
3.1-10.00	3	Up to 30 small lesions per plant or 1 lesions per 20 leaflet attacked.
10.1-24.0	4	Most plants are viable attacked by late blight, 1 or 3 leaflets infected but few multiple infection per

		leaflet.
25.0-29.0	5	Nearly every leaflet have lesions, multiple infections per leaflet is common. Field or plot looks green, but plants in plots infected.
55.0-74.0	6	All plants have blight and half the leaf area is infected. Plots looks green, freckled and brown blight is very obvious.
75.0-90.0	7	As previous, but ¾ of each plant have blight, lower branches may be overwhelming filled of, and the only green leaves of any are the top of the plants. Shade of the plant maybe more and spindly due to extensive foliage loss. That looks neither brown nor green.
91.0-97.0	8	Some leaves and most stems are green. Plots look down brown with some green patches.
98.0-99.9	9	Few green leaves, almost all that remark are those with blight lesions. Many stem lesion, plot looks brown. All leaves and stem are dead.
100.0	9	All leaves and stem dead.

[1] Description: 1-Highly resistant; 2-3 Resistant; 4-5 Moderately resistant; 6-7 Moderately susceptible; 8-9 Susceptible.

4. Leaf miner incidence. The appearance of leaf miner was observed at 45, 60 and 75 DAP (CIP, 2000):

SCALE	DESCRIPTION	REMARKS
1	Less infested (1-20 %)	Resistant
2	Infested (20-40 %)	Moderately resistant
3	Moderately infested	Intermediate
4	Severely infested (41-60 %)	Moderately susceptible
5	Most serious	Susceptible

5. Weight of marketable tubers per plant (g). All tubers that have marketable size not malformed, free from cuts, cracks, free from diseases and without more than 10 % greening of the total surface were counted and weighed at harvest.

6. Weight of non-marketable tubers per plant (g). This was obtained by counting all tubers that are marble in size, malformed, disease infested and has 10 % or more greening.

7. Total yield per plant (g). This was the sum of weight of the marketable and non-marketable tubers.

8. Dry matter content (%). Dry matter content of potato tubers were taken using the following formula:

$$DMC = 100\ \% - \%\ MC$$

Where: $$\%\ MC = \frac{FW - DW}{FW} \times 100$$

9. Cost and return analysis. These are the production cost, gross income, net profit and return on cash expense (ROCE). ROCE was computed using the following formula:

$$ROCE = \frac{\text{Net profit}}{\text{Total cost of production}} \times 100$$

Data Analysis

All quantitative data was analyzed using analysis of Variance (ANOVA) in 3 x 10 factorial in randomized complete design (RCBD) with three replications. The significance of difference among treatment means was tested using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Soil Chemical Properties

The initial and final analysis of the soil taken from the experimental are shown in Table 1.

The initial pH of the soil was 6.31 with organic matter content of 2.5 %. The nitrogen, phosphorous and potassium content of the soil are 0.12 %, 124 ppm and 308 ppm, respectively.

The soil applied with sunflower had an increased pH. This confirms the findings of Baldo (1989) that application of 100 % sunflower would increase the pH level of the soil. The organic matter content of the soil had increased and this could be due to the addition of organic materials. The phosphorous content of the soil applied with BSU compost and sunflower had increased from 118 to 124 ppm. The potassium content of soil had increased from 308 ppm to 375 ppm.

Table 1. Soil analysis before and after planting

	pH	OM (%)	N (%)	P (ppm)	K (ppm)
Before planting	6.31	2.5	0.12	124	308
After planting					
Control	6.25	2.5	0.12	118	373
BSU compost	6.57	2.8	0.14	124	333
Wild sunflower	7.21	3.0	0.15	123	375

Plant Vigor

Effect of potato entries. There were no significant differences observed among the ten potato entries on plant vigor at 30 DAP. At 45 DAP, only entries 676070 and 5.19.2.2 were vigorous while the other entries were moderately vigorous.

Effect of organic fertilizers. Table 2 shows the plant vigor of ten potato entries as affected by different organic fertilizers. At 30 and 45 DAP, plants applied with BSU compost were significantly more vigorous than those plants with no organic fertilizer and sunflower.

Interaction effect. There were no significant interaction of potato entries and organic fertilizers on the plant vigor.

Table 2. Plant vigor at 30 and 45 DAP of ten potato entries as affected by different organic fertilizers

TREATMENT	PLANT VIGOR	
	30 DAP	45 DAP
Entry (A)		
IP84004.87	2[b]	3[b]
676070	2[b]	4[a]
575003	3[a]	3[b]
285411.22	3[a]	3[b]
5.19.2.1	2[b]	3[b]
5732.75	3[a]	3[b]
676089	2[b]	3[b]
5.19.2.2	3[a]	4[a]
Kennebec	3[a]	3[b]
Ganza	3[a]	3[b]
Organic fertilizer (A)		
Control	2[b]	3[b]
BSU compost	3[a]	4[a]
Sunflower	2[b]	3[b]
AxB	ns	ns
CV (%)	25.31	22.41

Means followed with the same letters are not significantly different by DMRT ($P < 0.05$).

Description: 1-Very poor growth; 2-Poor growth; 3- Moderately vigorous; 4 Vigorous; 5-Highly vigorous.

Late Blight Incidence

Effect of potato entries. Table 3 shows the reaction of ten potato entries as affected by different organic fertilizers to late blight. Entry 5.19.2.2 was highly resistant to late blight compared with the other entries which were rated resistant at 45 DAP. There were no significant differences among the potatoes entries at 60 and 75 DAP for late blight resistances, however, entries 5.19.2.1 and 5.19.2.2 were observed to be resistant.

Effect of organic fertilizers. Plants applied with sunflower, BSU compost and control were resistant to late blight infection at 45, 60 and 75 DAP. It was observed that plants applied with BSU compost were moderately resistant. This implies that the use of BSU compost made the plants stronger and may have caused the delay of late blight infection in the plants.

Table 3. Late blight incidence of ten potato entries as affected by different organic fertilizers

TREATMENT	LATE BLIGHT RATING		
	45 DAP	60 DAP	75 DAP
Entry (A)			
IP84004.87	Resistant	Moderately susceptible	Susceptible
676070	Resistant	Moderately susceptible	Susceptible
575003	Resistant	Moderately susceptible	Susceptible
285411.22	Resistant	Moderately susceptible	Susceptible
5.19.2.1	Resistant	Resistant	Resistant
5732.75	Resistant	Resistant	Moderately resistant
676089	Resistant	Moderately resistant	Moderately resistant
5.19.2.2	Highly resistant	Resistant	Resistant
Kennebec	Resistant	Moderately susceptible	Susceptible
Ganza	Resistant	Moderately resistant	Moderately resistant
Organic fertilizer (A)			
Control	Resistant	Moderately susceptible	Moderately susceptible
BSU compost	Resistant	Moderately resistant	Moderately resistant
Sunflower	Resistant	Moderately susceptible	Moderately susceptible

Leafminer Incidence

Effect of potato entries. Table 4 shows that at 45 DAP, most of the potato entries were resistant except for entries 676070 and 285411.22 which were moderately resistant to leafminer. At 65 DAP, most entries have moderate resistance to leafminer however, IP84004.67 was moderately susceptible. Infestation of leafminer had increased at 75 DAP.

Effect of organic fertilizer. It was observed that plants applied with BSU compost and sunflower were moderately resistant to leafminer at 45 DAP and 60 DAP, however at 75 DAP plants applied with BSU compost had intermediate resistance, while plants not applied with any organic fertilizer sunflower were moderately resistant to insect pests.

Table 4. Reaction to leafminer infestation at 45 and 75 DAP of ten potato entries as affected by different organic fertilizers

TREATMENT	LEAFMINER		
	45 DAP	60 DAP	75 DAP
Entry (A)			
IP84004.87	Resistant	Moderately susceptible	Susceptible
676070	Moderately resistant	Moderately resistant	Moderately susceptible
575003	Resistant	Moderately resistant	Moderately susceptible
285411.22	Moderately resistant	Moderately resistant	Susceptible
5.19.2.1	Resistant	Moderately resistant	Moderately resistant
5732.75	Resistant	Moderately resistant	Moderately resistant
676089	Resistant	Resistant	Intermediate
5.19.2.2	Resistant	Resistant	Moderately resistant
Kennebec	Resistant	Moderately susceptible	Susceptible
Ganza	Resistant	Moderately resistant	Moderately resistant
Organic fertilizer (A)			
Control	Resistant	Intermediate	Moderately susceptible
BSU compost	Moderately resistant	Moderately resistant	Intermediate
Sunflower	Moderately resistant	Moderately resistant	Moderately susceptible

Weight of Marketable Yield

Effect of potato entries. Results show that entry 676089 numerically produced the heaviest marketable tubers. Entry 573275 registered the least mean weight (Table 5).

Effect of organic fertilizers. Plants applied with BSU compost numerically produced the heaviest potato tubers. Plants with no organic fertilizers produced the least weight of marketable tubers. The heavy tubers produced from plants applied with BSU compost could be attributed to more nutrients (Balaoing, 2006).

Interaction effect. There were no significant interaction between the ten potato entries and different organic fertilizers on marketable tubers of the plant.

Non-marketable Yield

Effect of potato entries. Entry 676089 produced the heaviest non-marketable tubers.

Effect of organic fertilizers. Plants applied with BSU compost, sunflower and control did not significantly differ on non-marketable yield.

Interaction effect. There were no significant interaction between the ten potato entries and organic fertilizers on the weight of non-marketable tubers of the plant.

Total Yield

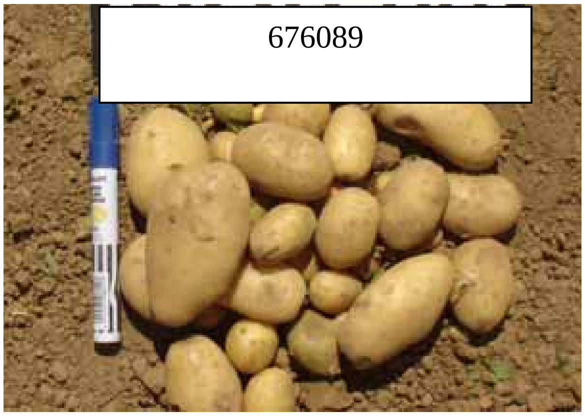
Effect of potato entries. Entry 676089 produced the highest total yield of potato tubers followed by entry 575003. The least yield was obtained from entry 5732.75.

Effect of organic fertilizers. Plants applied with BSU compost produced the highest total yield, followed by plants applied with sunflower. Plants with not fertilizers gave the least total yield of potato which could be due to the absence of organic matter that can be used by the plants to enhance tuberization. Figure 2 shows the harvested tubers from plants applied with the different organic fertilizers.

Interaction effect. There were no significant interaction between the ten potato entries and different organic fertilizers on the total yield of potato.

Table 5. Marketable, non-marketable and total yield of ten potato entries as affected by different organic fertilizers

TREATMENT	YIELD (g/plant)		
	MARKETABLE	NON-MARKETABLE	TOTAL
Entry (A)			
IP84004.87	23	2	25
676070	29	1	30
575003	39	1	37
285411.22	24	2	26
5.19.2.1	30	2	32
5732.75	19	1	20
676089	39	3	42
5.19.2.2	27	1	28
Kennebec	29	1	30
Ganza	26	1	27
Organic fertilizer (A)			
Control	23^b	2	25
BSU compost	35^a	2	37
Sunflower	27^b	1	28
AxB	ns	ns	ns
CV (%)	27.42	32.93	26.46



a. Entry 676089 not applied with any organic fertilizer

b. Ganza applied with BSU compost

c. Entry 575003 applied with sunflower

Figure 2. Representative entries applied with organic fertilizers

Dry Matter Content

Effect of potato entries. Table 6 shows the dry matter content of potato tubers. Entry 5.19.2.2 gave the highest dry matter content of tubers but comparable to entry 676089. The least was obtained from entry 676070. The dry matter content of the potato tubers were observed to be good for processing of chips since it ranges from 18 to 24 %.

Effect of organic fertilizers. As shown in Table 6, there were no significant differences on the dry matter content of tubers. Plants had similar DMC of 21 %.

Interaction effect. There were no significant interaction between the ten potato entries and the different organic fertilizers.

Table 6. Dry matter content of potato tubers as affected by different organic fertilizers

TREATMENT	DMC (%)
Entry (A)	
IP84004.87	21^{bcd}
676070	19^{d}
575003	22^{abc}
285411.22	20^{cd}
5.19.2.1	21^{bcd}
5732.75	22^{abc}
676089	23^{ab}
5.19.2.2	24^{a}
Kennebec	21^{bcd}
Ganza	20^{cd}
Organic fertilizer (A)	
Control	21
BSU compost	21
Sunflower	21
AxB	ns
CV (%)	7.22

Means followed with the same letters are not significantly different by DMRT (P < 0.05).

Cost and Return Analysis

Seed Tuber Production

Effect of potato entries. Entry IP84004.87 produced the highest ROCE of 109.80 followed by entry 676089 (106.36 %) and the least was obtained from Kennebec (37.57 %). High ROCE of the two potato entries are due to high yield of seed tubers.

Effect of organic fertilizers. Plants not applied with any organic fertilizers registered the highest ROCE of 236.39 %. This is due to low cost of production and no cost of fertilizers. It was observed that plants applied with BSU compost registered the lowest ROCE of 17.90 %. This is due to high cost of production and fertilizer. Plants applied with sunflower has a ROCE of 81.84 %.

Table 7a. Cost and return analysis of ten potato entries for seed tuber production as affected by different organic fertilizers (per $5m^2$)

TREATMENT	YIELD ($5m^2$)	GROSS SALE (Php)	TOTAL EXPENSES	NET INCOME	ROCE (%)
Entry (A)					
IP84004.87	61.00	122.00	58.15	63.85	109.80
676070	51.00	102.00	58.15	43.85	75.40
575003	48.00	96.00	58.15	37.85	65.09
285411.22	52.00	104.00	58.15	45.85	78.84
5.19.2.1	48.00	96.00	58.15	37.85	85.09
5732.75	47.00	94.00	58.15	35.85	61.65
676089	60.00	120.00	58.15	61.85	106.36
5.19.2.2	56.00	112.00	58.15	53.85	92.60
Kennebec	40.00	80.00	58.15	21.85	37.57
Ganza	41.00	82.00	58.15	23.85	41.01
Organic fertilizer (A)					
Control	43.90	87.80	26.10	61.70	236.39
BSU compost	48.50	97.00	82.27	14.73	17.90
Sunflower	60.10	120.20	66.10	54.1	81.84

*Total expenses include: cost of fertilizer, botanical fungicide, planting materials, fuel for irrigation, labor cost for land preparation, weeding, irrigation and other activities.
**Selling price was P 2.00/tuber.

<u>Interaction effect</u>. Among the three organic fertilizer used and ten potato entries, plants with no fertilizers and entry 676089 registered the highest ROCE for seed tuber production (Table 7b).

Table 7b. Cost and return analysis of potato seed tuber production (per 5m^2)

TREATMENT	YIELD (5m^2)	GROSS SALE (Php)	TOTAL EXPENSES	NET INCOME	ROCE (%)
Control					
IP84004.87	45	90	26.10	63.90	244.82
676070	48	96	26.10	65.90	267.81
575003	44	88	26.10	61.90	237.16
285411.22	47	94	26.10	67.90	260.15
5.19.2.1	43	86	26.10	59.90	229.50
5732.75	52	104	26.10	77.90	298.46
676089	53	106	26.10	82.90	306.13
5.19.2.2	48	96	26.10	69.90	267.81
Kennebec	38	76	26.10	49.90	191.18
Ganza	21	42	26.10	15.90	60.91
BSU compost					
IP84004.87	40	80	82.27	-2.27	-2.75
676070	60	120	82.27	37.73	45.86
575003	43	86	82.27	3.73	4.53
285411.22	47	94	82.27	11.73	14.25
5.19.2.1	50	100	82.27	11.73	21.55
5732.75	32	64	82.27	-18.27	-22.20
676089	54	108	82.27	25.73	31.27
5.19.2.2	48	96	82.27	13.73	16.68
Kennebec	44	88	82.27	5.73	6.96
Ganza	59	118	82.27	35.73	43.43
Sunflower					
IP84004.87	89	178	66.10	111.90	169.28
676070	46	92	66.10	25.90	39.18
575003	58	116	66.10	49.90	75.49
285411.22	63	126	66.10	59.90	90.62
5.19.2.1	50	100	66.10	33.90	51.28
5732.75	58	116	66.10	49.90	75.49
676089	72	144	66.10	77.90	117.85
5.19.2.2	72	144	66.10	77.90	117.85
Kennebec	37	76	66.10	9.90	14.97
Ganza	56	112	66.10	45.90	69.44

*Total expenses include: cost of fertilizer, botanical fungicide, planting materials, fuel for irrigation, labor cost for land preparation, weeding, irrigation and other activities.
**Selling price was P 2.00/tuber.

Table Potato Production

Effect of potato entries. Table 8a shows that negative ROCE was obtained from all the entries. Numerically, the highest ROCE was obtained from entry 573275 (-59.41 %). The negative ROCE could be due to low yield and high cost of production.

Effect of organic fertilizers. It was observed that plants not applied with any organic fertilizer gave the lowest ROCE. Highest ROCE was obtained from plants applied with BSU compost (-61.10 %)

Interaction effect. Among the combinations of ten potato entries and different organic fertilizers, Kennebec not applied with any organic fertilizer exhibited the highest ROCE (56.32 %) followed by entry 676089 not also applied with any organic fertilizer. Low ROCE was obtained from the other treatment combinations. This could be due to low yield and high cost of production (Table 8b).

Table 8a. Cost and return analysis of ten potato entries for table potato production as affected by different organic fertilizers (per $5m^2$)

TREATMENT	YIELD ($5m^2$)	GROSS SALE (Php)	TOTAL EXPENSES	NET INCOME	ROCE (%)
Entry (A)					
IP84004.87	0.71	28.40	58.15	-29.75	-51.16
676070	0.87	34.80	58.15	-23.35	-40.15
575003	1.07	42.80	58.15	-15.35	-26.39
285411.22	0.72	28.80	58.15	-29.35	-50.47
5.19.2.1	0.89	35.60	58.15	-2.55	-38.77
5732.75	0.59	23.60	58.15	-21.55	-59.41
676089	1.16	46.40	58.15	-11.75	-20.20
5.19.2.2	0.82	32.80	58.15	-25.35	-43.59
Kennebec	0.88	35.20	58.15	-22.95	-39.46
Ganza	0.77	30.80	58.15	-27.35	-47.03
Organic fertilizer (A)					
Control	0.63	25.20	26.10	-0.74	-28.35
BSU compost	0.80	32.00	82.27	-50.27	-61.10
Sunflower	1.04	41.60	66.10	-24.50	-37.06

*Total expenses include: cost of fertilizer, botanical fungicide, planting materials, fuel for irrigation, labor cost for land preparation, weeding, irrigation and other activities.
**Selling price was P 40.00/tuber.

Table 8b. Cost and return analysis for table potato production (per $5m^2$)

TREATMENT	YIELD ($5m^2$)	GROSS SALE (Php)	TOTAL EXPENSES	NET INCOME	ROCE (%)
Control					
IP84004.87	0.48	19.20	26.10	-6.90	-26.43
676070	0.72	29.00	26.10	2.90	11.11
575003	0.75	30.00	26.00	3.90	14.94
285411.22	0.51	20.10	26.10	-6.00	-23.37
5.19.2.1	0.63	25.20	26.10	-0.90	-3.44
5732.75	0.48	19.20	26.10	-6.90	-26.43
676089	0.99	39.60	26.10	13.50	51.72
5.19.2.2	0.9	27.60	26.10	1.50	5.74
Kennebec	1.02	40.80	26.10	14.70	56.32
Ganza	0.72	29.00	26.10	2.90	11.11
BSU compost					
IP84004.87	0.54	21.60	82.27	-60.67	-73.74
676070	1.08	43.20	82.27	-39.07	-47.48
575003	1.47	58.80	82.27	23.47	-28.52
285411.22	0.87	34.80	82.27	-47.47	-57.70
5.19.2.1	1.11	44.00	82.27	-37.87	-46.03
5732.75	0.45	18.00	82.27	-64.27	-78.12
676089	0.60	24.00	82.27	-28.27	-70.82
5.19.2.2	0.69	27.60	82.27	-54.67	-66.45
Kennebec	0.54	21.60	82.27	-60.67	-73.74
Ganza	0.69	27.60	82.27	-57.67	-66.45
Sunflower					
IP84004.87	1.11	44.40	66.10	-21.70	-32.82
676070	0.81	32.40	66.10	-33.70	-50.98
575003	0.99	39.60	66.10	-26.50	-40.09
285411.22	0.78	31.20	66.10	-34.90	-52.79
5.19.2.1	0.93	37.20	66.10	-28.90	-43.72
5732.75	0.84	33.60	66.10	-32.50	-49.16
676089	1.89	75.60	66.10	9.50	14.37
5.19.2.2	1.08	43.20	66.10	-22.90	-34.64
Kennebec	1.08	43.20	66.10	-22.90	-34.64
Ganza	0.90	36.00	66.10	-30.10	-45.53

*Total expenses include: cost of fertilizer, botanical fungicide, planting materials, fuel for irrigation, labor cost for land preparation, weeding, irrigation and other activities.
**Selling price was P 40.00/tuber.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Agronomic characters of ten potato entries applied with different organic fertilizers were assessed at BSU Experimental station, Balili, La Trinidad, Benguet from November 2005 to February 2006. The objectives were to: determine the best performing potato entry applied with organic fertilizers based on yield and resistance to pest and diseases; determine the kind of organic fertilizer that will produce the highest yield in potato under La Trinidad, Benguet condition; determine the combination of organic fertilizer and potato entry that will give the best performance in terms of yield and determine the economics of using organic fertilizer on the different potato entries.

Among the ten potato entries, 676070 and 5.19.2.2 were the most vigorous. Entries 5.19.2.1 and 2.19.2.2 were the most resistant to late blight at 75 DAP. Entry 676089 had intermediate resistance to leafminer. In terms of yield entry 676089 produced the highest total yield and dry matter content but not significantly different with entry 5.19.2.2. Entry 676089 obtained the highest ROCE sold as seed tubers and table potato.

Plants applied with BSU compost where the most vigorous and had intermediate resistance to leafminer infestation and late blight incidence. In terms of yield, plants applied with BSU compost produced the highest marketable and total yield. Dry matter content was not significantly different among plants applied with BSU compost, sunflower and those plants not applied with any organic fertilizer. Plants not applied with any organic fertilizer registered the highest ROCE for seed tuber production.

There were no significant interaction observed among the ten potato entries as affected by the different organic fertilizers on all the parameters measured. However, numerically, the best combination based on marketable and total yield is entry 676089 applied with sunflower.

Conclusion

Plants applied with BSU compost produced the highest yield in potato under La Trinidad, Benguet condition. Entry 676089 was the best performing potato entry in terms of yield and resistance to pests and diseases. Entry 676089 not applied with any organic fertilizers was the best performing combination in terms of yield and ROCE for seed tuber and table potato production. The use of organic fertilizers on the different potato entries was profitable when sold as seed tubers.

Recommendation

Based on the results of the study, entry 676089 with no organic fertilizers could be recommended for seed tuber organic production under La Trinidad condition. Entries Kennebec and 676089 could be recommended for table potato organic production. Non-application of organic fertilizer is possible for potato production under La Trinidad, Benguet condition.

LITERATURE CITED

ANDAYA, M.B. 1999. Cut flower quality of carnation (*Red Barbara Ear*.) grown at different media using BSU formulated compost. BS Thesis. BSU, La Trinidad Benguet. P.21.

BALAOING J. 2006. Personal conversation. Benguet State University, La Trinidad Benguet.

BALAOING and LAGMAN. 2003. Performance of selected horticultural crops using formulated vermicompost. BSU Research Journal 38: 28-34.

BATT, P.J. 1999. Potato production in the Philippines. Curtin University of Technology in Perlin, Australia. *http://www.potatocongress.org.2005*.

BALDO, M.S. 1989. Comparative study of Azolla and sunflower compost combined with inorganic fertilizer on the growth and yield of white potato using stem cuttings. BS Thesis. BSU, La Trinidad Benguet. Pp. 7 & 8.

CAMPIWER, R.B. 1999. Growth and yield response of potato (*Solanum tuberosum*) to different mixtures of organic fertilizers and liming. BS Thesis. BSU, La Trinidad Benguet. Pp. 44-45.

CECAP. 2000. Highland rice production in the Philippine Cordillera. Philrice Nueva Ecija. Pp. 122-123.

CIP, 2000. Compiled data sheet (loose sheet) CIP 2000.

COOKE. 1977. Towards a more sustainable agriculture. AVI Publishing Company, Inc. Westport, Connecticut. P.26.

CUYAHON, R.T. (1996). Organic fertilization on strawberry (*Fragaria vesca*). BS Thesis. BSU, La Trinidad Benguet. Pp. 6.

DA-BPI. 2003. Mychorrhiza and chicken manure: An alternative to inorganic fertilizer application on potato. Guisad, Baguio City. Pp. 1-2.

DURANTE, B.C. 1982. Effects of different rates of wild sunflower on the grow the growth and yield of inoculated garden pea. BS Thesis. BSU, La Trinidad Benguet. P. 64.

ESLAO, R.U.1996. Organic fertilizer of cabbage (*Brassica oleracea*). BS Thesis. BSU. La Trinidad Benguet. P. 33.

GADO, C. L. 2006. Is gong organic the best option?" Use of indigenous materials as organic source on rice paddy soil. Philrice, Central experiment station. Maligaya Munoz, Nueva Ecija. *www.Philrice.gov.ph*.

GALAGAL M.M. 2002. Varietal response of sweetpotato to organic fertilizer under La Trinidad Benguet condition. BS Thesis. BSU, La Trinidad Benguet. Pp. 16-17.

MERCADO, E.G. 1996. Influence of Alnus compost on the growth yield of potato. BS Thesis. BSU, La Trinidad Benguet. P. 2.

OTA. 1982. Towards a more sustainable agriculture. AVI Publishing Company, Inc. Westport, Connecticut. P. 117.

PANDOSEN, M.D. 1980. Effect of different rates of N-K and organic fertilizers on the yield of iron potato. BSU, La Trinidad Benguet. Pp. 116-117.

PARNES R. 1986. Organic and inorganic fertilizers. Mt. Vernon: Woods End Agricultural Institute. Pp. 97-120.

POINCELOT, R.1980. Towards a more sustainable agriculture. AEI Publishing Company, Inc. Westport, Connecticut. P. 75.

TOLEDO, L.R. 1982. Growth and yield response of white potato to different kinds and rates of organic matter under greenhouse condition. BS Thesis. BSU, La Trinidad Benguet. Pp. 37-38.

APPENDICES

APPENDIX TABLE 1. Plant vigor of ten potato entries as affected by different organic fertilizers at 30 DAP

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	2	2	2	6	2
E_2	3	2	2	7	2
E_3	3	1	3	7	2
E_4	3	3	2	8	3
E_5	2	2	2	6	2
E_6	3	3	2	8	3
E_7	3	2	2	7	2
E_8	2	2	2	6	2
E_9	3	2	3	8	3
E_{10}	3	4	2	9	3
Sub-Total	27	23	22	72	24
Fertilizer 2					
E_1	2	2	2	6	2
E_2	3	2	3	8	3
E_3	4	3	2	9	3
E_4	2	3	3	8	3
E_5	2	2	2	6	2
E_6	2	3	3	8	3
E_7	2	1	3	6	2
E_8	2	3	2	8	3
E_9	3	2	3	9	3
E_{10}	3	3	3	9	3
Sub-Total	25	24	27	76	25
Fertilizer 3					
E_1	3	3	2	8	3
E_2	1	4	3	8	3
E_3	4	2	3	9	3
E_4	3	3	3	9	3
E_5	3	2	3	8	3
E_6	4	4	4	12	4
E_7	3	3	3	9	3
E_8	3	3	3	9	3
E_9	3	4	2	9	3
E_{10}	5	4	3	12	4
Sub-Total	32	31	29	92	31
GRAND TOTAL	84	78	78	240	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	2	2	3	7	8
E_2	2	3	3	8	3
E_3	2	3	3	8	3
E_4	3	3	3	9	3
E_5	2	2	3	7	2
E_6	3	3	4	10	3
E_7	2	2	3	7	2
E_8	2	3	3	8	3
E_9	3	3	3	9	3
E_{10}	3	3	4	10	3
TOTAL	24	25	31	80	
MEAN	2.4	2.5	3.1		2.67

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.689	0.344			
Treatment	29	22.322	0.770	1.68		
Entry (A)	(9)	10.322	1.147	2.50^{*}	2.04	2.74
T (B)	(2)	8.289	4.144	9.02^{**}	3.16	4.99
A x B	(18)	3.711	0.206	0.49^{ns}	1.18	2.31
Error	58	26.644	0.459			
TOTAL	89	49.656				

** – Highly significant
* – Significant
ns – Not significant

Coefficient of Variation = 25.31 %

APPENDIX TABLE 2. Plant vigor of ten potato entries as affected by different organic fertilizers at 45 DAP

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	3	3	2	8	3
E_2	3	4	2	9	3
E_3	4	2	3	9	3
E_4	4	3	2	9	3
E_5	3	2	2	7	2
E_6	3	3	2	8	3
E_7	3	3	3	9	3
E_8	2	2	3	7	2
E_9	4	2	2	8	3
E_{10}	3	4	2	9	3
Sub-Total	32	28	23	83	28
Fertilizer 2					
E_1	4	2	2	8	3
E_2	5	3	3	11	4
E_3	4	4	2	10	3
E_4	3	3	2	8	3
E_5	3	2	2	7	2
E_6	2	3	2	7	2
E_7	3	2	2	7	2
E_8	4	4	4	12	4
E_9	3	3	3	9	3
E_{10}	2	4	3	9	3
Sub-Total	33	30	25	88	29
Fertilizer 3					
E_1	4	4	2	10	3
E_2	4	5	3	12	4
E_3	4	3	3	10	3
E_4	2	3	3	8	3
E_5	3	3	4	10	3
E_6	4	3	3	10	3
E_7	5	5	3	13	4
E_8	5	5	4	14	5
E_9	4	5	3	12	4
E_{10}	5	4	3	12	4
Sub-Total	40	40	31	111	37
GRAND TOTAL	105	98	79	282	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	3	3	3	9	3
E_2	3	4	4	11	4
E_3	3	3	3	9	3
E_4	3	3	3	9	3
E_5	2	2	3	7	2
E_6	3	2	3	8	3
E_7	3	2	4	9	3
E_8	2	4	5	11	4
E_9	3	3	4	10	3
E_{10}	3	3	4	10	3
TOTAL	28	29	36	93	
MEAN	2.8	2.9	3.6		3.1

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	12.067	6.033			
Treatment	29	35.733	1.232	12.23		
Entry (A)	(9)	9.511	1.057	2.14*	2.04	2.74
T (B)	(2)	14.867	7.433	15.07**	3.16	4.99
A x B	(18)	11.356	0.631	1.28ns	1.18	2.31
Error	58	28.600	0.493			
TOTAL	89	76.400				

** – Highly significant
* – Significant
ns – Not significant

Coefficient of Variation = 22.41 %

APPENDIX TABLE 3. Weight of marketable tubers as affected by different organic fertilizers

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	12	22	13	47	16
E_2	11	35	25	71	24
E_3	23	25	24	72	24
E_4	23	18	10	51	17
E_5	17	17	30	64	21
E_6	16	21	10	47	16
E_7	59	22	17	98	33
E_8	13	10	45	68	23
E_9	26	45	30	101	34
E_{10}	21	33	20	74	25
Sub-Total	221	248	224	693	231
Fertilizer 2					
E_1	28	11	15	52	18
E_2	53	30	25	108	36
E_3	39	11	20	70	23
E_4	55	21	12	88	29
E_5	75	15	20	110	37
E_6	10	22	13	45	15
E_7	19	14	28	61	20
E_8	34	17	19	70	23
E_9	21	18	15	54	18
E_{10}	100	31	16	178	49
Sub-Total	434	190	183	624	208
Fertilizer 3					
E_1	40	52	18	110	37
E_2	13	39	28	80	27
E_3	23	20	46	89	30
E_4	16	33	28	77	26
E_5	11	60	21	92	31
E_6	42	22	19	83	28
E_7	44	66	80	190	63
E_8	22	56	29	107	36
E_9	35	61	13	109	36
E_{10}	43	41	16	100	33
Sub-Total	289	450	298	1,037	346
GRAND TOTAL	944	888	705	2,537	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	16	18	37	71	24
E_2	24	36	27	87	29
E_3	24	23	30	77	26
E_4	17	29	26	72	24
E_5	21	37	31	89	30
E_6	16	15	28	56	20
E_7	33	20	63	116	39
E_8	23	23	36	82	27
E_9	34	18	36	88	29
E_{10}	25	49	33	107	36
TOTAL	233	268	347	848	
MEAN	23.3	26.8	34.7		28.27

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	15.756	7.878			
Treatment	29	71.167	2.454			
Entry (A)	(9)	29.378	3.264	0.10^{ns}	2.04	2.74
T (B)	(2)	0.622	0.311	0.75	3.16	4.999
A x B	(18)	41.156	2.286	1.0^{ns}	1.81	2.31
Error	58	189.579	3.269	0.70^{ns}		
TOTAL	89	276.489				

^{ns} – Not significant   Coefficient of Variation = 32.93 %

APPENDIX TABLE 4. Weight of non-marketable tubers as affected by different organic fertilizer

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	2	2	3	7	2
E_2	1	1	1	3	1
E_3	1	1	2	4	1
E_4	1	1	5	7	2
E_5	2	6	1	9	3
E_6	1	1	3	5	1
E_7	1	1	1	3	1
E_8	1	1	1	3	1
E_9	1	1	3	5	2
E_{10}	1	1	0	2	1
Sub-Total	12	16	20	48	16
Fertilizer 2					
E_1	3	0	1	4	1
E_2	2	1	0	3	1
E_3	1	1	1	3	1
E_4	3	2	0	5	2
E_5	2	5	1	8	3
E_6	1	1	1	3	1
E_7	1	1	3	5	2
E_8	3	1	1	5	2
E_9	1	1	1	3	1
E_{10}	1	1	1	3	1
Sub-Total	18	14	10	42	15
Fertilizer 3					
E_1	5	1	0	6	2
E_2	1	1	1	3	1
E_3	2	0	1	3	1
E_4	3	1	0	4	1
E_5	2	1	1	4	1
E_6	1	1	1	3	1
E_7	14	1	0	15	5
E_8	3	1	1	5	2
E_9	0	0	0	0	0
E_{10}	2	1	0	3	1
Sub-Total	33	8	5	46	15
GRAND TOTAL	63	38	35	136	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	2	1	2	5	1
E_2	1	1	1	3	1
E_3	1	1	1	3	1
E_4	2	2	1	5	1
E_5	3	3	1	7	2
E_6	1	1	1	3	1
E_7	1	2	5	8	3
E_8	1	2	2	5	1
E_9	2	1	0	3	1
E_{10}	1	1	1	3	1
TOTAL	15	15	15	45	
MEAN	1.5	1.5	1.5		1.5

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	1,041.622	520.811			
Treatment	29	9,442.456	325.602			
Entry (A)	(9)	2,658.456	295.384	3.62^{*}	2.04	2.74
T (B)	(2)	2,047.022	1,023.511	1.15	3.16	4.999
A x B	(18)	4,736.978	263.165	1.04^{ns}	1.81	2.31
Error	58	16,379.711	282.409	0.93^{ns}		
TOTAL	89	26,863.789				

** – Highly significant
^{ns} – Not significant

Coefficient of Variation = 27.42 %

APPENDIX TABLE 5. Total yield of ten potato entries as affected by different organic fertilizers

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	14	24	16	54	18
E_2	12	36	26	74	25
E_3	24	26	26	76	25
E_4	24	19	15	58	19
E_5	19	23	31	73	24
E_6	17	22	13	52	17
E_7	60	23	18	101	34
E_8	13	11	46	70	23
E_9	27	46	33	106	35
E_{10}	22	34	20	76	25
Sub-Total	232	264	244	740	247
Fertilizer 2					
E_1	31	11	16	58	19
E_2	55	31	25	111	37
E_3	40	12	21	73	24
E_4	58	23	12	93	31
E_5	77	20	21	118	39
E_6	11	23	14	48	16
E_7	20	15	31	66	22
E_8	37	18	20	75	25
E_9	22	19	16	57	19
E_{10}	101	32	17	150	50
Sub-Total	452	204	193	849	283
Fertilizer 3					
E_1	45	53	18	116	39
E_2	14	40	29	83	28
E_3	25	20	47	92	31
E_4	19	34	28	81	27
E_5	13	61	22	93	32
E_6	43	23	20	86	29
E_7	58	67	80	205	68
E_8	25	57	30	112	37
E_9	35	61	13	109	36
E_{10}	45	42	16	103	34
Sub-Total	322	458	303	1,083	361
GRAND TOTAL	1,006	926	740	2,672	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	18	19	39	76	25
E_2	25	37	28	90	30
E_3	25	24	31	80	27
E_4	19	31	27	77	26
E_5	24	39	32	95	32
E_6	17	16	29	62	21
E_7	34	22	68	124	41
E_8	23	25	37	85	28
E_9	35	19	36	90	30
E_{10}	25	50	34	109	36
TOTAL	245	282	361		
MEAN	24.5	28.2	36.1		29.6

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	124.689	620.844			
Treatment	29	10,117.956	348.895	1.27		
Entry (A)	(9)	2,819.733	313.304	1.14^{ns}	3.16	4.99
T (B)	(2)	2,047.622	1,023.811	3.03^{ns}	2.04	2.74
A x B	(18)	5,250.660	291.700	1.06^{ns}	1.81	2.31
Error	58	15,921.64	274.511	1.56^{ns}		
TOTAL	89	27,281.289				

^{ns} – Not significant

Coefficient of Variation = 26.46 %

APPENDIX TABLE 6. Dry matter content of potato tubers as affected by different organic fertilizers

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
Fertilizer 1					
E_1	21	22	21	64	21
E_2	22	21	22	65	22
E_3	16	19	25	60	20
E_4	21	19	19	59	20
E_5	19	21	21	61	20
E_6	24	22	21	67	22
E_7	24	23	24	71	24
E_8	25	24	23	72	24
E_9	20	20	19	59	20
E_{10}	22	22	21	65	20
Sub-Total	214	213	216	643	20
Fertilizer 2					
E_1	22	22	21	65	22
E_2	17	18	19	54	18
E_3	20	16	18	54	18
E_4	19	20	20	59	20
E_5	20	20	23	63	21
E_6	22	23	21	66	22
E_7	23	26	22	71	24
E_8	25	28	22	75	25
E_9	22	22	21	65	22
E_{10}	22	21	23	66	22
Sub-Total	212	216	210	638	213
Fertilizer 3					
E_1	20	21	21	62	21
E_2	19	19	18	56	19
E_3	21	21	21	63	21
E_4	21	19	20	60	20
E_5	22	22	20	64	21
E_6	25	24	18	67	22
E_7	21	23	23	67	22
E_8	23	22	20	65	22
E_9	21	22	20	63	21
E_{10}	22	23	21	66	22
Sub-Total	215	216	202	633	211
GRAND TOTAL	641	645	628	18	

TWO-WAY TABLE

ENTRY	ORGANIC FERTILIZER			TOTAL	MEAN
	CONTROL	COMPOST	SUNFLOWER		
E_1	21	22	21	65	21
E_2	22	18	19	59	20
E_3	20	18	21	59	20
E_4	20	20	20	60	60
E_5	20	21	21	62	21
E_6	22	22	22	66	22
E_7	24	24	22	70	23
E_8	24	25	222	71	24
E_9	20	22	21	63	21
E_{10}	22	22	22	66	22
TOTAL	215	214	211		
MEAN	21.5	21.4.	21.1		21.33

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	5.956	2.978			
Treatment	29	240.456	8.297			
Entry (A)	(9)	172.900	19.2111	0.29^{ns}	2.04	2.74
T (A)	(2)	1.356	0.678	3.61^{ns}	3.16	4.999
A x B	(18)	66.200	3.68	8.15^{**}	1.81	2.31
Error	58	136.711	2.357	1.56^{ns}		
TOTAL	89	383.122				

** – Highly significant

^{ns} – Not significant

Coefficient of Variation = 7.22 %