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VALDEZ, ARGIE DONGLAL. APRIL 2011. Growth and Yield of Potato Grown from Stem Cuttings as Affected by Induyan Organic Fertilizer. Benguet State University, La Trinidad,Benguet.

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ABSTRACT

This study was conducted to determine the effect of Induyan compost on the performance of potato during the cool dry season from December 2010 to February 2011.

Results revealed that the application of Induyan compost could improve the haulm weight and tuber yield of potato. Although not significant, the highest marketable yield at 13.04 t/ha was obtained with the application of Induyan compost at 5 kg/5 m^2 plot and from which the highest return on investment of 263.31% was derived.

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INTRODUCTION

The potato (*Solanum tuberosum Linn.*) is the most common vegetable grown in the highlands and mid-elevation areas of Benguet and Mountain province in Northern Luzon. The potato is one preferred because of satisfying return on investment when cultural management is properly employed. However, it is becoming more difficult to expand the production in the region because of the limited availability of suitable land. As production shift to marginal areas, as forest cover is removed greater amounts of land are becoming subject to erosion. Because of land limitations few potato growers doing the recommended crop rotation, relying instead of greater quantities of purchased inputs (fertilizer and pesticides) to continuous production and to control the increasing incidence of pests (Gayao and Sim, undated).

The growth and yield of potato depends on many factors such as planting materials, planting density, proper fertilization and others. The use of stem cuttings as planting materials is very promising for low cost potato production. It also enables the rapid and timely increase of new cultivars and prevents possible occurrence of tuber-borne diseases. It reduces production input by a decrease cost of planting material per unit area and by a decrease of fungicide application. The potato requires heavy kind of fertilizers and this is one of the production factors to be considered in successful farming. Proper kind of fertilizer plays an important role in making a good environment for potato production and other crops (Dalang *et al*., 1998).

The use of organic fertilizer and organic based fungicides/insecticides result to good growth, yield, safe and tasty vegetables. Organic fertilizer makes soil in good condition and rich in nutrient elements. Fields with enrich soil let vegetables grow fast, healthy and strong. Growth continuous until the time of harvest because the soil continuous to provide nutrients. Plants have fewer pest and diseases and vegetables can be harvested in shorter days. Products are larger and look better and they contain vitamins and minerals in larger percentage. The use of organic- based materials will let us save at least half of chemicals and fertilizers compared with traditional farming practices (Yokomori, 2007).

The study aimed to determine the effect of Induyan compost on the growth and yield performance of potato, the optimum level of application of Induyan compost for potato, and the economics of using Induyan compost in potato production.

The study was conducted at horticulture laboratory area, BSU, La Trinidad, Benguet from December 2010 to February 2011.

REVIEW OF LITERATURE

Organic-Based Vegetable Production

Soil enrichment. The basic factor of farming lies in soil enrichment. Healthy soil rich in organic materials makes healthy crops. Fertilizers do not produce crops. Soil richness lets vegetable grow. Farmers not aware of this fact try to grow vegetables by inorganic fertilizers and farm chemicals only. Then, the soil loses its health and the crops become sick. Many vegetables fields here in Benguet are in serious condition. Soil is hard and plant roots do not penetrates deep into it. It contains air and moisture little. Soil microorganism is inactivating. It is deficient in major (NPK) and micronutrients. Plants suffer from soil-born pest and disease such as club roots. What causes this problem? Farmers grow same type of vegetable repeatedly, depleting major (i.e. NPK) and micronutrients. Lack of organic materials in the soil eliminates small bugs, earthworm, fungus and bacteria, which eat and propagate on these materials. Absence of this creature let the soil be compact and poor in air and moisture. Vegetables planted on this field grow poorly and unevenly. Products are small and look poor. Their mineral and vitamin contents are lower than normal. They are susceptible to pest and diseases, need frequent spraying, causing chemical residues to be higher in the products (Yokomori, 2007).

Compost production and uses. Farmers need to return the basic of farming. The soil has to recover its activity. We have to start from composting the fields. How do we produce compost? Make full use of locally available materials. We can find many different materials such as weeds in wasteland and roadside, fallen leaves, rice straws, vegetable clippings, animal manure, etc. Gather them band cut them into right sizes. Find right mix of these materials rich in Carbon and nitrogen. Adjust their moisture pile them up. When temperature goes beyond 60-70 degrees Celsius, disband the heap to cool it and pile it again. It may not be possible for you to use that much of compost at a time. You may instead, spread 20 sacs per 1,000 square meters 2-3 times a year. It is important for as to repeat it every year .The first year production may not indicate any recognizable changes. The effects become gradually clearer when we repeat it 2-5 years. Please do not stop here! When you continue it every year and you will find your soil will be as active as ever. You will continue producing healthy and tasty vegetables. Vegetable production on enrich soil has another advantage. Weather is unstable these days because of global warming. Heavy rain washes the fields in the midst of dry season and temperature change abruptly from very high to very low. This prevents vegetables to grow normally. However, vegetables planted on enrich soil grow healthy band strong and they neither get damage much by weather nor suffer from pest and diseases. Since other farms get lower production and the market is short of supply, you will enjoy good production with higher prices (Yokomori, 2007).

Production of charcoal and Mokusaku (wood-vinegar). When charcoal and mokusaku is mixed with compost materials, we can produce better quality compost in shorter time. Charcoal is porous and contains air and moisture, which offers favourable living conditions to useful microorganism. Its effectiveness is valid both in compost and soil conditioning. Mokusaku (wood vinegar) helps fermentation of compost materials. It eliminates noxious microorganisms and enhances useful ones to propagate. Organic materials contained in Mokusaku become nutrients to plants and microorganism. It is also effective when it is fertigated to soil around the plants. How do we produce charcoal and mokusaku? Any material of plant origin which is burnable can be used. Example: woods, bamboos, coconut shells, rice husk, dried weeds ECT. Carbonate it and you get charcoal. Coal smoke (gas) emitted by heated materials and you get Mokusaku (Yokomori, 2007).

Healthy vegetables. Cultivating vegetables resembles bringing child up: Grow them strong and healthy. Vegetables on rich soil grow strong. A child grow fast and strong when its mother is healthy and gives enough from her breast. Strong seedlings come first. Put seeds on pathogen-free soil. Good seedlings soil makes helps germination in growth to great extent. When seeds germinate, irrigate everyday .Do not mis -planting time: Plants then on the field before the seedlings gate too aged. Early stage growth is very important. Let plants grow fast and big. They grow good when soil is in good condition and rich in nutrition. Poorer nutrition and slower growth causes the plants to be attack by pest and diseases more badly .If you find the soil is short of nutrition, please do not hesitate to give chemical fertilizer. If young plants get attack by insects and diseases, spray chemicals and mokusaku immediately. Early spraying prevents massive outbreaks in later stage. It makes near harvest spraying unnecessary. And the end, total amount of chemical used is reduced and its residues in the harvested vegetables are eliminated (Yokomori, 2007).

Can vegetable grow without chemicals? Vegetables may grow without chemicals fungicides /insecticides and without inorganic fertilizer. However, the products look poor and have insect bites, unless the grower has quiet high level of technology and grow them under intensive care. While they are free from chemical residues, some data indicate lower vitamin and mineral contents of the organic vegetables. Do consumers buy them? Perhaps yes. But its quantity is small and represents only a small fraction of the whole consumption. It is not easy for the producers. It takes a large amount of manpower. Yield is low. Hence a sale does not cover the costs unless a high price is charged. Even so, marketable quantities are limited. Can income from organic vegetables pay the living expenses for the family? It may be quite difficult (Yokomori, 2007).

Fertilizer Application in Potato Production

The procedure for fertilizer application is to apply chicken manures (1 can/12 m^2) and complete fertilizer (½ of the recommended rate) and thoroughly mixed with the soil prior to planting. Side dressing of the remaining ½ of the recommended rate of complete fertilizer between the rows one month after planting (Gayao *et al*., 1998).

Cultural Management Practices

Cultural management of white potato transplant is similar to those grown from seed tubers. However, an application of foliar fertilizer (high in nitrogen) one week after transplanting is necessary to encourage more vegetative production and to prevent early tuber formation. It is also important to hill-up twice to cover nodes and minimize greening of tubers. Hilling- up is done 30 days after planting (DAP) with side dressing of 140-140-140 kg N- P_2O_5 – K_2O/ha at 45 DAP (Dalang *et al*., 1998).

MATERIALS AND METHODS

Materials

The materials used were potato stem cuttings of ‘Granola’, Induyan compost, chicken manure, triple 14, fungicides, insecticides, and farm tools.

Induyan compost it is an organic fertilizer that helps to increase beneficial microorganisms in the soil, thus improving soil condition making plants vigorous and resistant to diseases. It contains 1.67 % nitrogen, 2.67% phosphorous, 3.30% potassium, 8.1 pH, 52.5% micro nutrients, and 16.87% organic matter content.

Method

Experimental design and treatments. The experiment was laid out in randomized complete block design (RCBD) with three replications. The treatments were as follows:

Code	Fertilizer
F_1	Chicken manure- 2 t/ha or 1 kg/5 m^2+ 14-14-14- 571 kg/ha or 0.285 kg/ 5m^2
F_2	Induyan compost- 5.0 t/ha or 2.5 kg/5 m^2
F_3	Induyan compost- 10 t/ha or 5.0 kg/5 m^2
F_4	Induyan compost- 15 t/ha or 7.5 kg/5 m^2

Land preparation, planting, and crop maintenance. An area of 60 square meters was prepared. The area was divided into four blocks and each block was composed of four plots with a dimension of 1 m x 5 m each. Cuttings were transplanted at 25 cm x 30 cm between hills and rows in a double row plot (1m wide). Prior to planting, Induyan compost and chicken dung were applied and mixed thoroughly with the soil. Inorganic fertilizer 14-14-14 was applied to treatments plots three weeks after transplanting followed by hilling-up. All other cultural management practices like irrigation, weeding, insect and disease control were employed properly.

Data Gathered

1. Final height (cm). This was measured from the base to the tip of the shoot at maturity.

2. Haulm weight (kg). This was the weight of the vegetative parts taken at harvest time.

3. Days to maturity. This was the number of days from planting to harvesting when the leaves turned yellowish.

4. Weight of marketable tubers according to sizes (kg/5 m^2 plot).

a. Extra large tubers: 99-105 grams

b. Large tubers: 85-98 grams

c. Big tubers: 78-84 grams

d. Medium tubers: 51-77 grams

e. Small tubers: 50 grams and below

5. Number of tubers according to sizes per plot. This was the number of tubers according to sizes.

6. Marketable yield (kg/5 m^2 plot). This was the total weight of tubers without defects and are saleable.

7. Non-marketable yield (kg/5 m^2 plot). This was the total weight of very small tubers, diseased or with defects.

8. Total yield (kg/5 m^2 plot). This was the weight of marketable and non-marketable tubers.

9. Computed marketable yield (t/ha). The marketable yield per plot was multiplied by 2000 which is the number of 1x5m plots per hectare and divided by 1000 which is the number of kilogram per ton.

10. Soil analysis. The N, P, K and organic matter content was taken during land preparation prior to the application of fertilizer.

11. Temperature data . This was taken from the PAG-ASA station near the site of the study.

12. Cost and return analysis. Return on investment was computed using the formula:

$$\text{Percentage ROI} = \frac{\text{Net Income}}{\text{Total Expenses}} \times 100$$

13. Documentation. This was the pictures taken during the study.

RESULTS AND DISCUSSION

Final Height, Haulm Weight, and Days to Maturity

In Table 1 and Figure 1, results shows that plant height was not significantly affected by the fertilizer treatments while haulm weight was significantly higher in plants applied with Induyan compost at 7.5 and 5 kg per 1 x 5 m^2 plot. Plants applied with chicken manure + 14-14-14 significantly matured the earliest after 68 days from planting.

Weight of Classified Tubers

Table 2 shows that the weight of tubers classified according to size were not significantly different as affected by the different fertilizer treatments. Nevertheless, the highest weight of small and extra large tubers were obtained with the application of Induyan compost at 7.5 kg/5 m^2 plot, medium and big sized tubers with the application of 5 kg/5 m^2 plot Induyan compost, and large tubers with the application of chicken manure + 14 -14-14.

Table 1. Final height, haulm weight, and days to maturity

FERTILIZER TREATMENT (per 5 m^2 plot)	FINAL HEIGHT (cm)	HAULM WEIGHT (kg)	DAYS TO MATURITY
Chicken manure- 1 kg + 14-14-14- 0.285 kg	55.00^{a}	2.50^{bc}	68.33^{b}
Induyan Compost- 2.5 kg	54.57^{a}	2.33^{c}	70.07^{a}
Induyan Compost- 5.0 kg	58.00^{a}	3.33^{ab}	70.33^{a}
Induyan Compost- 7.5 kg	59.33^{a}	3.67^{a}	70.67^{a}

Means with a common letter are not significantly different at 5% level by DMRT

Four weeks after transplanting

Six weeks after transplanting

Figure 1. Vegetative stage of the treatment plants

Table 2. Weight of classified tubers

FERTILIZER TREATMENT (per 5 m^2 plot)	CLASSIFICATION				
	SMALL	MEDIUM	BIG	LARGE	EXTRA LARGE
Chicken manure-1 kg + 14-14-14- 0.285 kg	0.73[a]	1.44[a]	1.30[a]	1.19[a]	0.90[a]
Induyan Compost- 2.5 kg	0.74[a]	1.19[a]	1.31[a]	0.78[a]	0.74[a]
Induyan Compost- 5.0 kg	1.02[a]	1.68[a]	1.63[a]	1.05[a]	1.14[a]
Induyan Compost- 7.5 kg	1.06[a]	1.39[a]	1.21[a]	1.04[a]	1.16[a]

Means with a common letter are not significantly different at 5% level by DMRT

Number of Classified Tubers

Table 3 shows that the number of tubers classified according to size were not significantly different in the different treatments except the number of small tubers which was significantly higher with the application of 5.0 kg/5 m^2 plot Induyan compost. Nevertheless, the highest number of medium and big size tubers were obtained with the application of 5 kg/5 m^2 plot Induyan compost, large tubers with the application of chicken manure + 14-14-14, and extra large tubers with the application of 5 kg/5 m^2 plot Induyan compost.

Tuber Yield

Tuber yield was not significantly affected by the different fertilizer treatments (Table 4 and Figure 2). However, greater yield of non-marketable tubers was obtained from plants applied with chicken manure + 14-14-14, while the highest marketable yield, total yield, and computed marketable yield of 13.04 t/ha were obtained with the application of Induyan compost at 5 kg/5 m^2 plot.

Potato tubers harvested from plants applied with chicken manure- 1 kg + 14-14-14- 0.285 kg/5 m^2 plot

Potato tubers harvested from plants applied with Induyan compost at 2.5 kg/5 m^2 plot

Potato tubers harvested from plants applied with Induyan compost at 5.0 kg/5 m^2 plot

Potato tubers harvested from plants applied with Induyan compost at 7.5 kg/5 m^2 plot

Figure 2. Samples of marketable tuber yield from the different fertilizer treatments

Table 3. Number of classified tubers

FERTILIZER TREATMENT (per 5 m^2 plot)	CLASSIFICATION				
	SMALL	MEDIUM	BIG	LARGE	EXTRA LARGE
Chicken manure- 1 kg + 14-14-14- 0.285 kg	34.33^{bc}	36.00^{a}	20.33^{a}	13.57^{a}	6.67^{a}
Induyan Compost- 2.5 kg	32.00^{c}	28.00^{a}	19.67^{a}	8.00^{a}	5.57^{a}
Induyan Compost- 5.0 kg	46.00^{a}	44.33^{a}	26.33^{a}	12.33^{a}	9.67^{a}
Induyan Compost- 7.5 kg	39.67^{b}	33.33^{a}	20.67^{a}	12.00^{a}	9.00^{a}

Means with a common letter are not significantly different at 5% level by DMRT

Table 4. Tuber yield

FERTILIZER TREATMENT (per 5 m^2 plot)	YIELD (kg/5 m^2 plot)			COMPUTED MARKETABLE YIELD (t/ha)
	NON-MARKETABLE	MARKETABLE	TOTAL	
Chicken manure- 1 kg + 14-14-14- 0.285 kg	0.35^{a}	5.56^{a}	5.91^{a}	11.13^{a}
Induyan Compost- 2.5 kg	0.28a	4.57^{a}	5.04^{a}	9.53^{a}
Induyan Compost- 5.0 kg	0.27^{a}	6.52^{a}	6.78^{a}	13.04^{a}
Induyan Compost- 7.5 kg	0.20^{a}	5.87^{a}	6.08^{a}	11.75^{a}

Means with a common letter are not significantly different at 5% level by DMRT

Soil Analysis

The soil in the experiment field prior to the application of fertilizer contained low amount at 0.025% N, 52 ppm P, 328 ppm K, 0.5% organic matter content, and high pH at 7.32.

Temperature Data

The temperature recorded during the cropping period is shown in Table 6. The highest temperature was recorded in December with a mean of 17.5^{o}c and decreased to 15.6^{o}c and 14.75^{o}c in January and February, respectively. These temperatures are within the suitable ranges for potato production.

Cost and Return Analysis

Table 6 shows that the highest return on investment (ROI) at 263.31% was obtained with the application of Induyan compost at 5 kg/5 m^2 plot while the lowest ROI was obtained with the application of 7.5 kg/5 m^2 plot Induyan compost at 190.36%.

Table 5. Temperature data

MONTH	TEMPERATURE (^{o}c)		
	MAXIMUM	MINIMUM	AVERAGE
December 2010	24	11.0	17.50
January 2011	20	11.2	15.60
February 2011	20	9.50	14.75

Table 6. Cost and return analysis

RETURN ON INVESTMENT (Per 5 m^2 plot)	FERTILIZER TREATMENT (per 5 m^2 plot)			
	Chicken manure- 1 kg + 14-14-14- 0.285 kg	Induyan Compost 2.5 kg	Induyan Compost 5.0 kg	Induyan Compost 7.5 kg
Marketable yield (kg)	16.69	14.29	19.56	17.62
A. Sales (Php)	418.5.00	351.2.00	483.2.00	438.45.00
B. Expenses				
Potato stem cuttings	60	60	60	60
Fertilizer				
1. Chicken manure	8.00	-	-	-
2. 14-14-14	18.81	-	-	-
3. Induyan compost	-	18.00	36.00	54.00
Insecticide	2.00	2.00	2.00	2.00
Fungicide	5.00	5.00	5.00	5.00
Labor	25.00	25.00	25.00	25.00
Transportation	5.00	5.00	5.00	5.00
Total expenses	123.81.00	115.00	133.00	151.00
C. Net profit (PhP)	294.69.00	236.2.00	350.2.00	287.45.00
D. ROI (%)	238.12%	205.39%	263.31%	190.36%
Rank	2	3	1	4

The selling prices (PhP) were: small=15.00, medium =20.00, big=25.00, large=30.00 and extra large =35.00.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at horticulture laboratory area of the Benguet State University La Trinidad, Benguet from December 2010 to February 2011 to determine the effect of Induyan compost on the growth and yield performance of potato, the optimum level of application of Induyan compost for potato, and the economics of using Induyan compost in potato production.

Findings show that significantly heavier haulm was obtained from plants applied with Induyan compost at 7.5 or 5 kg/5 m^2 plot. Height of plants did not differ significantly but significantly earlier maturity was noted in plants applied with chicken manure +14-14-14. Tuber yield was not significantly affected as to size and weight but the highest marketable yield at 13.04 t/ha was obtained with the application of Induyan compost at 5 kg/5 m^2 plot with the highest return on investment of 263.31%.

Conclusion

Based on the results, application of Induyan compost at 5 kg/5 m^2 plot could improve the vegetative growth and yield of potato and increase the income.

Recommendation

The use of Induyan compost at 5 kg/5 m^2 plot could be recommended in potato production to have better yield and higher profit.

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APPENDICES

Appendix Table 1. Final height (cm)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	45	61	59	165	55.00
Induyan Compost- 2.5 kg	51	55	58	164	54.67
Induyan Compost- 5.0 kg	62	63	49	174	58.00
Induyan Compost- 7.5 kg	68	57	53	178	59.33

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	36.5	18.25	0.24510 ^{ns}	4.757063	9.779538
Treatment	3	46.91667	15.63889			
Error	6	382.8333	63.80556			
TOTAL	11	466.25				

^{ns}- Not significant

Coefficient of variation = 14.08%

Appendix Table 2. Haulm weight (kg)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	3	2.5	2.0	7.5	2.500000
Induyan Compost- 2.5 kg	2	2.5	2.5	7.0	2.333333
Induyan Compost- 5.0 kg	4	3.0	3.0	10	3.333333
Induyan Compost- 7.5 kg	4	4.0	3.0	11	3.666667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.791667	0.395833	6.172414*	4.757063	9.779538
Treatment	3	3.729167	1.243056			
Error	6	1.208333	0.201389			
TOTAL	11	5.729167				

*- significant

Coefficient of variation = 15.17%

Appendix Table 3. Days to maturity

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	68	68	69	205	68.3333
Induyan Compost- 2.5 kg	70	70	70	210	70.0000
Induyan Compost- 5.0 kg	71	70	70	211	70.3333
Induyan Compost- 7.5 kg	70	71	71	212	70.6667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.16667	0.08333	10.5455 **	4.75706	9.77954
Treatment	3	9.66667	3.22222			
Error	6	1.83333	0.30556			

** - Highly significant

Coefficient of variation = 0.79%

Appendix Table 4. Weight of small tubers (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	0.80	0.80	0.60	2.20	0.73333
Induyan Compost- 2.5 kg	0.81	0.85	0.56	2.22	0.74000
Induyan Compost- 5.0 kg	1.30	0.94	0.83	3.07	1.02333
Induyan Compost- 7.5 kg	1.50	0.95	0.73	3.18	1.06000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.35712	0.17856	3.64155^{ns}	4.75706	9.77954
Treatment	3	0.28116	0.09372			
Error	6	0.15442	0.02574			
TOTAL	11	0.79269				

^{ns}- not significant Coefficient of variation = 18.04%

Appendix Table 5. Weight of medium tubers (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	1.75	1.52	1.05	4.32	1.44000
Induyan Compost- 2.5 kg	1.22	1.05	1.29	3.56	1.18667
Induyan Compost- 5.0 kg	1.45	2.20	1.38	5.03	1.67667
Induyan Compost- 7.5 kg	0.91	1.72	1.55	4.18	1.39333

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.23647	0.11823	0.8808^{ns}	4.75706	9.77954
Treatment	3	0.36409	0.12136			
Error	6	0.82673	0.13779			
TOTAL	11	1.42729				

^{ns}- Not significant

Coefficient of variation = 26.06%

Appendix Table 6. Weight of Big Tubers (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	0.75	1.35	1.80	3.90	1.300000
Induyan Compost- 2.5 kg	0.85	1.45	1.64	3.94	1.313333
Induyan Compost- 5.0 kg	2.62	1.45	0.81	4.88	1.626667
Induyan Compost- 7.5 kg	1.45	1.38	0.80	3.63	1.210000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	0.060200	0.030100	0.214892^{ns}	4.757063	9.779538
Treatment	3	0.298092	0.099364			
Error	6	2.774333	0.462389			
TOTAL	11	3.132625				

^{ns}- Not significant

Coefficient of variation = 49.91%

Appendix Table 7. Weight of large tubers (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	1.20	1.16	1.21	3.57	1.190000
Induyan Compost- 2.5 kg	0.40	0.48	1.47	2.35	0.783333
Induyan Compost- 5.0 kg	1.41	1.10	0.64	3.15	1.050000
Induyan Compost- 7.5 kg	0.85	1.03	1.25	3.13	1.043333

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.096017	0.048008	0.519781^{ns}	4.757063	9.779538
Treatment	3	0.258933	0.086311			
Error	6	0.996317	0.166053			
TOTAL	11	1.351267				

^{ns}- Not significant

Coefficient of variation = 40.08%

Appendix Table 8. Weight of extra large tubers (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	1.35	1.00	0.35	2.70	0.900000
Induyan Compost- 2.5 kg	0.61	0.80	0.81	2.22	0.740000
Induyan Compost- 5.0 kg	1.83	0.85	0.75	3.43	1.143333
Induyan Compost- 7.5 kg	2.35	0.40	0.75	3.50	1.166667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	1.81755	0.908775	0.47081^{ns}	4.757063	9.779538
Treatment	3	0.375892	0.125297			
Error	6	1.596783	0.266131			
TOTAL	11	3.790225				

^{ns}- Not significant

Coefficient of variation = 52.24%

Appendix Table 9. Number of small tubers (per 5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	38	39	26	103	34.33333
Induyan Compost- 2.5 kg	38	32	26	96	32.00000
Induyan Compost- 5.0 kg	54	48	36	138	46.00000
Induyan Compost- 7.5 kg	46	45	28	119	39.66667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	504	252	15.38235**	4.757063	9.779538
Treatment	3	348.6667	116.2222			
Error	6	45.33333	7.555556			
TOTAL	11	898				

** - highly significant

Coefficient of variation = 7.23%

Appendix Table 10. Number medium tubers (per 5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	43	38	27	108	36.00000
Induyan Compost- 2.5 kg	28	23	33	84	28.00000
Induyan Compost- 5.0 kg	43	61	32	136	45.33333
Induyan Compost- 7.5 kg	24	41	35	100	33.33333

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	170.1667	85.08333	1.601353^{ns}	4.757063	9.779538
Treatment	3	473.3333	157.7778			
Error	6	591.1667	98.52778			
TOTAL	11	1234.667				

^{ns}- Not significant

Coefficient of variation = 27.83%

Appendix Table 11. Number of big tubers (per 5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	11	22	28	61	20.33333
Induyan Compost- 2.5 kg	11	22	26	59	19.66667
Induyan Compost- 5.0 kg	42	23	14	79	26.33333
Induyan Compost- 7.5 kg	24	26	12	62	20.66667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	21.5	10.75	0.221958^{ns}	4.757063	9.779538
Treatment	3	85.58333	28.52778			
Error	6	771.1667	128.5278			
TOTAL	11	878.25				

^{ns}- Not significant

Coefficient of variation = 52.12%

Appendix Table 12. Number of large tubers (per 5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	15	13	13	41	13.66667
Induyan Compost- 2.5 kg	4	5	15	24	8.000000
Induyan Compost- 5.0 kg	17	13	7	37	12.33333
Induyan Compos- 7.5 kg	11	11	14	36	12.00000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	6.5	3.25	0.846255^{ns}	4.757063	9.779538
Treatment	3	53.66667	17.88889			
Error	6	126.8333	21.13889			
TOTAL	11	187				

^{ns}- Not significant

Coefficient of variation = 39.98%

Appendix Table 13. Number of extra large tubers (per 5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	11	7	2	20	6.666667
Induyan Compost- 2.5 kg	5	6	6	17	5.666667
Induyan Compost- 5.0 kg	17	7	5	29	9.666667
Induyan Compost- 7.5 kg	18	3	6	27	9.000000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	152	76	0.658163^{ns}	4.757063	9.779538
Treatment	3	32.25	10.75			
Error	6	98	16.33333			
TOTAL	11	282.25				

^{ns}- Not significant

Coefficient of variation = 52.15%

Appendix Table 14. Marketable yield (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	5.85	5.83	5.01	16.69	5.563333
Induyan Compost- 2.5 kg	3.90	4.63	5.77	14.30	4.766667
Induyan Compost- 5.0 kg	8.61	6.54	4.41	19.56	6.520000
Induyan Compost- 7.5 kg	7.06	5.48	5.08	17.62	5.873333

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	3.337517	1.668758	0.963002^{ns}	4.757063	9.779538
Treatment	3	4.772292	1.590764			
Error	6	9.911283	1.651881			
TOTAL	11	18.02109				

^{ns}- Not significant

Coefficient of variation = 22.62%

Appendix Table 15. Non-marketable yield (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	0.15	0.35	0.55	1.05	0.35
Induyan Compost- 2.5 kg	0.32	0.25	0.26	0.83	0.276667
Induyan Compost- 5.0 kg	0.33	0.23	0.25	0.81	0.27
Induyan Compost- 7.5 kg	0.21	0.22	0.2	0.63	0.21

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.009017	0.004508	0.743252^{ns}	4.757063	9.779538
Treatment	3	0.0296	0.009867			
Error	6	0.07965	0.013275			
TOTAL	11	0.118267				

^{ns}- Not significant

Coefficient of variation = 41.64%

Appendix Table 16. Total yield (kg/5 m^2 plot)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION				
	I	II	III	TOTAL	MEAN
Chicken manure- 1 kg + 14-14-14- 0.285 kg	6.00	6.18	5.56	17.74	5.913333
Induyan Compost- 2.5 kg	4.22	4.88	6.03	15.13	5.043333
Induyan Compost- 5.0 kg	8.94	6.74	4.66	20.34	6.78.000
Induyan Compost- 7.5 kg	7.27	5.70	5.28	18.25	6.083333

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	3.03965	1.519825	0.899632^{ns}	4.757063	9.779538
Treatment	3	4.5899	1.529967			
Error	6	10.20395	1.700658			
TOTAL	11	17.8335				

^{ns}- Not significant

Coefficient of variation = 21.90%

Appendix Table 17. Computed marketable yield (t/ha)

FERTILIZER TREATMENT (per 5 m^2 plot)	REPLICATION			TOTAL	MEAN
	I	II	III		
Chicken manure- 1 kg + 14-14-14- 0.285 kg	11.70	11.66	10.02	33.38	11.12667
Induyan Compost- 2.5 kg	7.800	9.26	11.54	28.6	9.533333
Induyan Compost- 5.0 kg	17.22	13.08	8.82	39.12	13.04000
Induyan Compost- 7.5 kg	14.12	10.96	10.16	35.24	11.74667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGRESS OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	COMPUTED F	TABULAR F	
					0.05	0.01
Replication	2	13.35007	6.675033	0.963002^{ns}	4.757063	9.779538
Treatment	3	19.08917	6.363056			
Error	6	39.64513	6.607522			
TOTAL	11	72.08437				

^{ns}- Not significant

Coefficient of variation = 22.62%