Influence of Inorganic Fertilizers Containing Sulfur on the Yield and Quality of Three Processing Potato Cultivars [1/]

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ABSTRACT

The study aimed to identify the best inorganic fertilizer containing sulfur affecting growth and yield of processing potato cultivars Kennebec, Columbus and Po_3, know the effects of inorganic fertilizer containing sulfur on the postharvest quality of processing potato cultivars, and identify the best cultivars for processing as affected by different inorganic fertilizers containing sulfur.

Po_3 was the tallest and significantly produced the highest marketable yield up to 22.16 t/ha., produced higher dry matter content and specific gravity but had lower ash content and consistently exhibited the highest reducing sugars up to 6.22% contributing to darker color of chips.

Kennebec was the shortest, produced the lowest marketable yield, had dry matter content and specific gravity insignificant with the other cultivars, gave the highest ash content and lowest reducing sugars which resulted to very light chip color.

Columbus produced yield comparable to Po_3, yielded tubers with higher dry matter and ash contents and highest specific gravity.

The three cultivars and the application of the different inorganic fertilizers containing sulfur produced firm, crispy and perceptible chips except control with slightly perceptible. Ammonium Sulfate and Triple-14 application significantly promoted growth as indicated by increased height of plants. Further, they increased the marketable yield by 3.76 t/ha and 2.6 t/ha. On the other hand, application of Potassium Sulfate produced the highest dry matter content, highest

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specific gravity and ash content of potato tubers. It also increased the potassium content of the soil based on the initial content. Moreover, its application together with Ordinary Superphosphate increased the pH of the soil. In contrast, control had the shortest plants, lowest marketable yield, and highest non-marketable yield, produced tubers with similar dry matter content, specific gravity and highest ash content.

Po_3 applied with Ammonium Sulfate consistently was the tallest and produced higher marketable yield followed by the same cultivar fertilized with Triple-14. However, it produced tubers with high reducing sugar content leading to darker color of chips. In comparison, Columbus applied with Potassium Sulfate gave tubers with the lowest reducing sugar, higher dry matter content, highest specific gravity and ash content.

RATIONALE

Potato is one of the best and most popular root crops which has been grown successfully in the highlands of Benguet, Mountain Province and other areas with similar agro-climatic situations. It is a herbaceous plant that belongs to the Solanaceae family and has maturity ranging from three to four months depending on the variety. According to Alipit (1978), this crop thrives best in areas of 300 to 1,500 meters above sea level and with a temperature of 15 to 25°C in a well drained loam soil having a pH ranging from 5.5 to 6.5.

Potato quality has been traditionally related to tuber size, shape, appearance, shallow eyes, free from injuries and defects and edibility of the cooked tubers. However, because of the increasing demands for processing potato and continuing campaign for improved nutrition, other quality considerations are being emphasized such as high dry matter content and low reducing sugars to quality chips and French fries.

According to Killick and Simmonds (1974), tuber quality of potatoes could be modified and improved by cultural and environmental factors. One cultural management factor is through fertilization. The application of sulfur with the use of potassium sulfate increases the starch content and other quality component of tubers (Parnes, 1986). Further, sulfur is responsible in adding flavor or aroma and required for chlorophyll formation to yield carbohydrates and increase starch content (Devlin, 1977).

OBJECTIVES

1. Identify the best inorganic fertilizer containing sulfur affecting growth and yield of processing potato cultivars.
2. Know the effects of inorganic fertilizers containing sulfur on the postharvest quality of processing potato cultivars. Identify the best cultivars for processing as affected by different inorganic fertilizers containing sulfur.

REVIEW OF LITERATURE

Variety is a great factor influencing the quality of potato tubers. Secondary are the cultural factor and environment where the crop is grown (Zaag, 1982).

According to Coumou (1985) the processing industry is very particular about quality and therefore, sets strict requirements to produce a high quality product on a cost-effective basis and these are size of at least 40-60 mm for chips and 50 mm and above for French fries, long-oval or long shape, free from injuries and defects, high dry matter content of 20-24% and low reducing sugars. Likewise, IAC (1989) recommended tubers with 50-55 mm size, smooth shapes, shallow eyes, with dry matter of 21% and low sugar content of at least 2% for processing purposes. However, dry matter content higher than 25% is no longer recommended because the resulting chips become too hard. Further, tubers with shallow eyes, long or oblong shape for adequate

strip length and with an average soluble solids of 21% or specific gravity of 1.081 are required by processing companies (Yang, 1993).

Earlier, Harris (1978) stated that specific gravity (starch or dry matter content) is an important measure of quality and indicator of mealiness used extensively by processors to assess the suitability for the production of French fries, chips and dehydrated products since yield of product is greater per unit fresh weight from tubers with high soluble solid content. Further, Fehr (1987) revealed that cultivars or tubers with high solid content are preferred for processing because they are cooked faster, absorb less oil if fried and indicates a mealy texture because of high amylose which is a component of starch.

Smith (1977) stressed out that sugar content causes browning and low content results to lighter color after cooking. This is attributed to the reaction of the reducing sugar with amino acids during the frying process (Maillard reaction). As a result dark brown substances are formed. He also added that brown discoloration after cooking is lessened when chips are blanched in hot water before frying to extract the reducing sugar.

Later, Santiago (1996) found out that the best sensory qualities of chips are light yellow in color, slightly oily, crispy and very perceptible.

Brady (1985) stressed that nitrogen is an essential component of the proteins and related amino acids which are critical not only as building blocks for plant tissue but also as in the cell nuclei and protoplasm in which the hereditary control is vested. He also added that it regulates the utilization of phosphorus, potassium and other constituents. Likewise, phosphorus improves the development of lateral and fibrous roots, and lessen plant maturity or counteracts the effects of nitrogen and constituents of nucleic acid, phospholipids, coenzymes, NAD, NADP, ATP and ADP. Meanwhile, potassium is important in the synthesis of amino acids and protein from ammonium ions, synthesis of starch and is required by plants for translocation of ammonium ions and sugar (Rue **et al.**,1986).

On the other hand, Epstein (1972) mentioned that sulfur is a property of certain enzymes concerned with photosynthesis and nitrogen fixation and this may be due to sulfur-linkages or bonds present. Moreover, some amino acids contain sulfur like cystein and methionine which are building blocks of protein and therefore, sulfur affects the protein quality of potato tubers (Mengel and Kirby, 1987). They further stated that the disulfide bonds of sulfur contribute to the formation of enzyme proteins responsible for glutelin formation for better consistency and baking quality of potato powder.

METHODOLOGY

The study was conducted for three trials. The first trial was during the rainy season (April-July) and the second and third trials were carried out during the dry season (November-February)

A 225 square meter area was thoroughly prepared for 15 treatment combinations replicated four times. Each treatment was assigned in a plot measuring 0.75 x 5 meters laid out in randomized complete block design (RCBD) involving factorial arrangement.

Inorganic fertilizer application was based at the rate of 150-150-150 kg N-$P_2$05-K_2O and supplemented with three (3) tons chicken manure per hectare. The required amount of chicken manure was applied basally in all treatment plots including the control. Split application of inorganic fertilizer was done wherein half was applied basally into the treatment plots while the remaining half was side-dressed at hilling-up one month after planting.

Single row method was used planting the seedpieces at a distance of 75 cm between rows and 25 cm between hills. There were 20 plant hills in every plot.

Spraying started two weeks from emergence and at weekly intervals thereafter to prevent insect pests and diseases. Yellow traps were also installed to prevent leafminer infestation. Irrigation was applied

weekly to maintain soil moisture for favorable growth and development. Weeding was done as need arose during the growth duration of the crop.

The treatment were as follows:

Factor A. Cultivars (C)

C_1 = Kennebec
C_2 = Columbus
C_3 = Po_3 (Agria was used in the second trial)

Factor B. Inorganic Fertilizer Containing Sulfur (F)

F_0 = Control
F_1 = Ammonium sulfate (21-0-0-24 S)
F_2 = Ordinary superphosphate (0-18-0-14 S)
F_3 = Potassium sulfate (0-0-50-17.6 S)
F_4 = Triple 14 with sulfur (14-14-14-12 S)

Data gathered:

A. Growth and Yield Parameters

1. Final height (cm). Plant heights were measured from 10 randomly selected sample plants 70 days after planting.
2. Marketable yield (t/ha). Total marketable tubers were classified by sizes, weighed at harvest and computed in tons per hectare.
3. Non-marketable yield (t/ha). Non-marketable tubers were also collected, weighed at harvest and computed in tons per hectare.

B. Chemical and Physical Properties of Tubers

1. Dry matter content (%). Dry matter content was taken by oven drying the sliced tubers for two days at 70°C. It was computed by using the formula:

$$\text{DMC (\%)} = \frac{\text{Oven dry weight}}{\text{Fresh weight}} \times 100$$

2. Sugar content (°Brix). Sugar content was determined from five (5) randomly selected sample tubers with the use of a refractometer.

3. Ash content (%). Ash content was obtained by using the formula:

$$\text{Ash content (\%)} = \frac{\text{Ash weight}}{\text{fresh weight}} \times 100$$

4. Specific gravity (g). Specific gravity was taken by weighing one (1) kilogram of tubers in air and under water using the hydrometer. It is computed using the formula:

$$\text{Specific gravity (g)} = \frac{\text{Weight in air}}{\text{Weight in air - weight in water}}$$

C. Sensory Qualities of Potato Chips

Potatoes were peeled, cut into chips and washed three (3) times, dried to remove the surface moisture and fried in vegetable oil at 180°C temperature. The chips were processed and evaluated by the Northern Philippine Root Crops Research and Training Center (NPRCRTC) processing and BPI research staff through the sensory evaluation system and parameters such as:

1. Color. Chips were evaluated using color characteristics: brown, light brown, yellow, light yellow and yellow cream.

2. Texture. Chip was evaluated using the criteria below:
   Firm - chip is solid or compact and do not disintegrate
   Soft - chip is smooth and easily shaped
   Hard - chip is not easily cut and punctured

3. Crispiness. Chips were evaluated using the criterion below:
   Very crispy - chip is very easy to crumble
   Crispy - chip is easy to crumble
   Moderately crispy - chip is crumbled without difficulty
   Slightly crispy - chip is crumbled with difficulty
   Not crispy - chip is hard to crumble

4. Flavor. Chips were evaluated based on perceptibility rating such as:
   Very perceptible - chip has a very strong flavor
   Perceptible - chip has a strong flavor
   Moderately perceptible - chip has little flavor
   Slightly perceptible - chip has very little flavor
   Not perceptible - chip has no flavor

D. Chemical Properties of the Soil

1. Initial and final pH, Nitrogen, Phosphorous, Potassium and Sulfate contents of the soil. Before the area was prepared for planting and after the study, composite soil samples were taken at random, air dried, pulverized and analyzed through.
   a. pH. This was taken through the use of a glass electrode pH meter.
   b. Nitrogen (%). This was determined by multiplying the organic matter content to a factor of 0.05.
   c. Phosphorous (ppm). Bray no. 2 method.
   d. Potassium (ppm). Flame photometer method
   e. Sulfate (ppm). Turbidemetric method.

RESULTS AND DISCUSSION

Effect of Cultivar:

Plant Height

Results showed that significant differences were observed on plant height as affected by cultivar (Table 1). Po_3 produced the tallest plants with mean height of 85.92 cm. and 80.03 cm. in the first and third trials, respectively. Shortest plants were obtained from Kennebec with 40.45 cm. and 38.08 cm. in the second and third trials, in order. The height of Po_3 was attributed to inherent varietal characteristics where it is generally viny and late maturing.

Yield

Po_3 significantly produced the highest marketable yields of 10.17 t/ha and 22.16 t/ha and the highest non-marketable yields of 0.87 t/ha and 1.62 t/ha in the first and third trials, respectively. This was because the cultivar generally produced more tubers of both desirable sizes and mini tubers compared to the two cultivars. Columbus produced the highest marketable yield of 27.35 t/ha in the second trial and consistently produced the lowest non-marketable yields of 0.73 t/ha, 0.77 t/ha and 0.59 t/ha in the three successive trials due to varietal characteristics of producing more yield of bigger sizes than mini tubers or rejects. The yield of the three cultivars were comparable to the national and regional yield of 15 t/ha and 20 t/ha, respectively during the dry season.

Dry Matter Content of Tubers

Columbus consistently had the highest dry matter content of 16.39%, 18.67% and 20.94% with an average of 18.66% (Table 2). The lowest dry matter content was taken from Kennebec with 16.25%, and 20.15% in the first and third trials. The low dry matter content of tubers was mainly influenced by varietal characteristics and watery tubers especially when grown during the rainy season.

Sugar Content of Tubers

Po_3 had the highest sugar content of 5.93 °Brix and 6.22 °Brix in the second and third trials while the lowest was obtained from Kennebec with 5.24 °Brix, 5.29 °Brix and 5.54 °Brix with an average

of 5.35 °Brix. Higher sugar content causes browning because of its reaction to amino acids during the frying process which resulted to darker chips. Lower sugar content resulted to lighter chip color.

Specific Gravity of Tubers

Columbus had the highest specific gravity of 1.085 grams followed by Po_3 with 1.083 grams while Kennebec gave the lowest specific gravity of 1.081 grams. This means that Columbus and Po_3 tubers were denser compared to Kennebec. These results coincide with the dry matter content where in the higher the specific gravity the higher the dry matter content.

Ash Content of Tubers

Kennebec gave the highest ash content of 5.96% while the lowest was Po_3 with 5.54%. This indicated that Kennebec contained more minerals than the two cultivars.

Tuber and Chip Qualities

Kennebec had oval tubers with white skin and flesh (Table 3) Columbus had oblong while Po_3 had round tubers; however, both had white skin and yellowish flesh.

Kennebec chips had creamy yellow color, firm and fine in texture, crispy and perceptible. Likewise, Columbus and Po_3 both had light yellow color, firm and coarse in texture, crispy with perceptible flavor.

Chemical Properties of the Soil

Cultivars did not significantly affect the pH and nitrogen content of the soil after harvest (Table 4). The decrease in pH based on initial content during the first trial was due to the rainy season where cations were leached.

Kennebec plots gave the lowest phosphorous contents of 93.30 ppm, 84.25 ppm and 102.65 ppm in the three trials while Po_3 plots gave the highest contents with 114.60 ppm and 140.20 ppm in the first and second trials. Kennebec plants had absorbed and removed more phosphate ion compared to Columbus and Po_3.

There were very slight differences observed on the potassium contents and notable differences were observed on the sulfate contents of the soil after harvest (Table 5). Columbus had the lowest sulfate contents of 20.97 ppm and 20.96 ppm in the first and second trials. This indicated that Columbus uptake of sulfate was more than the two cultivars.

Effect of Inorganic Fertilizers Containing Sulfur:

Plant Height

The application of Ammonium Sulfate consistently produced the tallest plants with 76.85 cm., 46.50 cm. and 56.97 cm. in the three trials (Table 6). This was followed by the application of Triple-14 with 75.35 cm., 42.35 cm. and 56.30 cm. while control produced the shortest plants with 57.50 cm., 36.47 cm. and 49.56 cm. This proved that fertilizers containing nitrogen promotes the growth of plants.

Yield

The application of Ammonium Sulfate produced higher marketable yield of 10.25 t/ha. 23.31 t/ha. and 18.26 t/ha. , while the lowest marketable yield was obtained from the control with 8.32 t/ha., 14.10 t/ha and 18.11 t/ha. in the three trials. Control also produced the highest non-marketable yield of 1.14 t/ha. and 1.84 t/ha. in the first and second trials. This indicated that application of Ammonium Sulfate supplied the nutrients needed by the plants which led to the production of more yield. On the other hand, control had insufficient nutrients needed by plants that resulted to the least production of quality yield

but more on mini tubers which are non-marketable. It was also observed that yield taken from the application of the different inorganic fertilizers were comparable to the national and regional yield of 15 t/ha and 20 t/ha, respectively. Further, incidence of bacterial blight was observed but insignificant to affect the yield.

Dry Matter Content of Tubers

Potassium Sulfate application consistently produced tubers with the highest dry matter content of 17.21%, 19.53% and 20.78%, respectively in the three trials (Table 7). Lowest dry matter content was obtained from Ammonium Sulfate application with 15.49% and 18.20% in the first and second trials. Application of potassium increases the starch content of tubers which is related to the dry matter content and the eating quality of chips and French fries while excess nitrogen lowers the dry matter content of potato tubers (Parnes, 1986).

Sugar Content of Tubers

Triple-14 application produced tubers with the highest sugar content of 6.22 °Brix and 6.03 °Brix in the first and second trials while the lowest was taken from Potassium Sulfate application with 4.85 ° Brix and 5.41 °Brix in the second and third trials. Higher sugar content caused browning and low content resulted to lighter color of chips after cooking. Further, the higher sugar content make it undesirable for processing purposes.

Specific Gravity of Tubers

Potassium Sulfate application produced tubers with the highest specific gravity of 1.086 grams while the lowest was taken from Ordinary Superphosphate application with 1.080 grams. Application of Potassium Sulfate increases the specific gravity which means more solid content that is related to the dry matter or starch content.

Ash Content of Tubers

Control produced tubers with the highest ash content of 6.15% while Ammonium Sulfate application gave the lowest ash content of 5.43%. This means that unfertilized plants produced tubers with higher minerals compared to plants applied with inorganic sulfur sources.

Chip Qualities

There were slight differences on the chip qualities as affected by inorganic fertilizers containing sulfur (Table 8). Triple-14 application produced chips with darker color compared to other sulfur sources. The application of all the inorganic fertilizers containing sulfur produced chips with firm, crispy and perceptible except control which produced slightly perceptible chips. Dark color of chips is attributed to the high sugar content. On the other hand, sulfur affects the flavor or aroma of the chips.

Chemical Properties of the Soil

Table 9 shows the analysis of the soil after harvest. Ammonium Sulfate application consistently had the lowest pH of 5.21, 5.30 and 5.36 followed by Triple-14 application with 5.27, 5.30 and 5.45, in the three trials, respectively. The application of fertilizers containing nitrogen reduces pH of the soil.

There were no significant differences observed on the nitrogen content of the soil.

The application of the different inorganic fertilizers containing sulfur significantly increased the phosphorus content from the initial contents of 94.00 ppm, 40.00 ppm and 42.00 ppm. This was because potato plants had absorbed and removed efficiently some of the available Phosphorus for their nutritional requirement.

The application of Potassium Sulfate remarkably increased the potassium content to 804.33 ppm, 648.83 ppm and 686.50 ppm followed by Triple-14 application with 552.58 ppm, 451.16 ppm and 536.41 ppm (Table 10). The lowest was taken from Ammonium

Sulfate application with 317.58 ppm, 319.50 ppm and 327.08 ppm. This was because Potassium Sulfate and Triple-14 contain potassium which contributed to the increase of potassium in the soil.

On the other hand, the sulfate content significantly decreased from 31.50 ppm and 25.00 ppm in the first and second trial to the extent of 13.71 ppm and 13.69 ppm. Potato plants had used and removed some of the nutrients for their growth and development.

Interaction Effect:

Plant Height

Po_3 applied with Ammonium Sulfate produced the tallest plants with 97.60 cm. and 82.55 cm. in the first and third trials (Table 11). Shortest plants were usually taken from the control plants; unfertilized Columbus with 47.80 cm. in the first trial and unfertilized Kennebec with 36.67 cm. in the second trial. Ammonium Sulfate contains nitrogen which promoted growth of the plants compared to the control plants with no nutrient replenishment.

Yield

Po_3 applied with Ammonium Sulfate produced higher marketable yield of 12.47 t/ha. 23.19 t/ha. in the first and second trials, respectively. Lowest marketable yield was obtained from unfertilized Columbus with 7.33 t/ha. and 11.03 t/ha in the first and third trials. Higher marketable yield was due to the application of nitrogen which is very much needed in the growth and development of the plants. In contrast, unfertilized plants of either cultivar usually produced lower marketable but higher non-marketable yield due to non replenishment of the major nutrient elements for nutritional development.

Dry Matter Content of Tubers

Po_3 and Kennebec applied with Potassium Sulfate had the highest dry matter content of 17.94% and 20.30% in the first and second

trials, and unfertilized Columbus and Po_3 applied with Triple-14 both with 21.66% in the third trials (Table 12). Potassium Sulfate increases the sugar content of potato tubers which is related to dry matter content and specific gravity. The higher the specific gravity, the higher the dry matter or starch content.

Sugar Content of Tubers

Po_3 applied with Triple-14 produced tubers with highest sugar content of 6.85 °Brix and 6.30 °Brix followed by the same cultivar applied with Ammonium Sulfate with 5.90 °Brix and 6.60 °Brix. Further, Columbus and Kennebec applied with Triple 14 and Ammonium Sulfate produced tubers with higher sugar content ranging from 5.25 °Brix to 6.50 °Brix. High sugar content causes browning which is undesirable for processing purposes. Low content results to lighter color after cooking.

Specific Gravity of Tubers

Columbus applied with Potassium Sulfate and Kennebec applied with Ordinary Superphosphate produced tubers with the highest specifrc gravity of 1.090 grams while unfertilizerd Kennebec and Columbus applied with Ordinary Superphosphate gave the lowest specific gravity both with 1.070 grams. High specific gravity means high dry matter or starch content and also indicates better eating quality.

Ash Content of Tubers

Kennebec applied with Ordinary Superphosphate produced tubers with the highest ash content of 6.82% followed by Columbus applied with Potassium Sulfate with 6.33%. High ash content indicates more minerals and protein content.

Chip Qualities

Results showed that on sensory evaluation, Kennebec applied with different inorganic fertilizers containing sulfur produced chips with creamy yellow color, firm and fine texture, crispy and perceptible chips (Table 13). Columbus and Po_3 applied with different sulfur sources also had light yellow, firm and coarse texture, crispy and perceptible chips. The unfertilized three cultivars produced chips which are slightly perceptible.

Chemical Properties of the Soil

Table 14 showed the significant differences on pH, nitrogen and phosphorous contents of the soil as affected by cultivars and inorganic fertilizers containing sulfur. Plots planted with the three cultivars applied with Ammonium Sulfate and Triple-14 had the lowest pH contents ranging from 5.10 to 5.60 while plots applied with other inorganic fertilizers containing sulfur including the control had higher pH ranging from 5.57 to 5.87. Meanwhile, Kennebec plots with no inorganic fertilizer had lower nitrogen contents of 0.075%, 0.093% and 0.093% in the three trials while higher nitrogen contents were from Po_3 plots applied with Triple-14 with means of 0.118% in the second and third trials. The decrease in nitrogen content from the initial contents of 0.055 and 0.15% was attributed to the absorption of plants and maybe due to loss of nutrients. Phosphorous contents of the soil was consistently lowest on control plots planted with Kennebec with 74.75 ppm, 69.25 ppm and 80.50 ppm.

Table 15 shows that plots applied with Ammonium Sulfate had the lowest potassium contents ranging from 297.50 ppm to 330.25 ppm. Highest potassium contents ranging from 596.50 ppm to 826.50 ppm was obtained from plots applied with Potassium Sulfate. On the other hand, sulfate content of the soil was consistently lowest on Columbus control plots with means of 12.86 ppm and 5 ppm Highest sulfate content was noted also in plots planted with Po_3 applied with Ordinary Superphosphate with means of 52.95 ppm and 4 ppm .

CONCLUSION AND RECOMMENDATION

Based on the results, Po_3 was the tallest, high yielding cultivar with higher dry matter content and specific gravity but with lower ash content and exhibited high reducing sugars contributing to darker color of chips.

Kennebec was short with low yield, gave comparable dry matter content and specific gravity but with high ash content and low reducing sugar that resulted to very light chip color.

Columbus produced yield comparable to Po_3 with the highest dry matter content and specific gravity and higher ash content of potato tubers.

The three cultivars produced firm and crispy chips with strong flavor with the application of the different inorganic fertilizers containing sulfur.

Ammonium Sulfate and Triple-14 application promoted growth in terms of plant height and increased the marketable yield of tubers by 1.5 tons/ha to 4.21 tons/ha.

Potassium Sulfate application increased the dry matter content, specific gravity and ash content of potato tubers. Its application together with Ordinary Superphosphate also increased the pH of the soil.

It is recommended that :

1. All the three cultivars are recommended for processing with rank preference of Po_3, Columbus then Kennebec, in order.

2. Potassium Sulfate as inorganic fertilizer is recommended for processing potatoes but nitrogen and phosphorus applications are important to produce higher and quality yield.

3. Potatoes should be planted during dry season to lessen the occurrence of diseases and to obtain higher yield and dry matter content.

BIBLIOGRAPHY

ALIPIT, P.B. 1978. Planting density and organic fertilizer study on the growth and yield of potato. Unpublished Master Thesis. MSAC, La Trinidad, Benguet. P. 2.

BRADY, N. C. 1985. Nature and properties of the soil. 9th ed. New York. Mac Millan Publishing Company. P. 284

COUMOU, D. 1982. Potato growing for industrial purposes. Netherlands Potato Consultative Institute. The Hague, The Netherlands. Pp. 1-5.

DEVLIN, R. 1977. Plant physiology. 3rd ed. New York. D. Van Nostrand Co. Pp. 359-362

EPSTEIN, 1972. Mineral nutrition of plants principles and perspective. Wiley International Edition. New York. John Wiley and sons, Inc. P. 20

FEHR, W.R. 1987. Principles of cultivar development. Crop Science. New York. Mc. Millan Pub. Co. Pp. 393-394.

HARRIS, P. M. 1978. The Potato Crop. New York. John Wiley and Sons, Inc. Pp. 214, 215, 217.

IAC, 1989. Production, storage and seed technology. Wageningen, The Netherlands. International Agricultural Center. P. 4, 5, 6, 10, 12

KILLICK, A. L. and L. A. SIMONDS. 1974. Soil and fertilizers. New York. John Wiley and Sons. Pp. 115-120.

MENGEL, K. K. and E. A. KIRBY. 1987. Principles of plant nutrition. Worblaun-Bern, Switzerland. International Potash Institute. Pp. 338-390

PARNES, R. 1986. Organic and inorganic fertilizers. New York. Woods and Agricultural Institute. Pp. 90-91.

RHUE, R. D. ET AL. 1986. Effect of potassium fertilization on yield and leaf nutrient concentrations of potatoes grown on a sandy loam soil. Am. Pot. J. 63 (12): 665-681

SANTIAGO, J.D. 1996. Quality of white potato tubers fertilized with different sources of potassium. Unpublished Undergraduate thesis. Benguet State University, La Trinidad, Benguet. P. 18.

SMITH, O. 1977. Potatoes production, strong and processing. Westpoint, Connecticut. The AVI Pub. Co., Inc., Pp. 265, 268, 277.

YANG, K. 1993. Status, constraints and opportunities for increasing white potato usage and processing. Pearl Drive, Ortigas Center, Pasig. M. M. Center for Research and Communication. Pp. 1-2

ZAAG, D. E. 1982. Potatoes and their cultivation in the Netherlands. Netherlands Potato Consultative Institute., MAP, Foreign Information. Pp. 35-39.

Table 1. Growth and yield of potato as affected by different cultivars

Cultivar	Height 70 DAP (cm)			Marketable yield (T/ha)			Non-marketable yield (T/ha)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
Kennebec	57.09^{b}	40.45^{a}	38.08^{c}	9.65^{a}	20.52^{b}	13.60^{b}	0.83^{a}	1.14^{a}	0.79^{b}
Columbus	56.08^{b}	47.28^{a}	44.75^{b}	9.33^{a}	27.35^{a}	14.82^{b}	0.73^{a}	0.77^{a}	0.59^{c}
Po_3	85.92^{a}	-	80.03^{a}	10.17^{a}	-	22.16^{a}	0.87^{a}	-	1.62^{a}
Agria		34.87^{b}			16.76^{c}			2.08^{a}	
CV (%)	9.52		16.46	14.96		11.56	19.43	17.92	16.90
	6.00			18.70					

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 2. Chemical and physical analysis of potato tubers as affected by different cultivars

Cultivar	DMC (%)			Sugar Content (^{0} Brix)			Specific Gravity (g)	Ash Content (%)
	1998	1999	2001	1998	1999	2001		
Kennebec	16.25^{a}	18.88^{a}	20.15^{b}	5.24^{b}	5.29^{ab}	5.54^{b}	1.081^{ab}	5.96^{a}
Columbus	16.39^{a}	18.67^{a}	20.94^{a}	5.50^{ab}	5.64^{a}	5.69^{b}	1.085^{a}	5.69^{ab}
Po_3	16.39^{a}	-	20.91^{a}	5.93^{a}	-	6.22^{a}	1.083^{a}	5.54^{b}
Agria		18.24^{a}			5.42^{ab}			
CV	9.69		5.92	12.88		7.10	6.00	6.80
(%)	3.10			8.90				

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 3. Tuber and chip qualities as affected by different cultivars

Cultivar	Tubers			Chips			
	Shape	Skin color	Flesh color	Color	Texture	Crispiness	Flavor
Kennebec	Oval	White	White	Yellow Cream	Firm	Crispy	Perceptible
Columbus	Oblong	White	Yellowish	Light Yellow	Firm	Crispy	Perceptible
Po_3	Round	White	Yellowish	Light Yellow	Firm	Crispy	Perceptible

Table 4. pH, nitrogen and phosphorus contents of the soil as affected by different Cultivars

Cultivar	pH			Nitrogen (%)			Phosphorus (ppm)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
Kennebec	5.53^a	5.56^a	5.62^a	0.081^a	0.098^a	0.098^a	93.30^b	84.25^b	102.65^b
Columbus	5.42^a	5.51^a	5.55^a	0.073^a	0.107^a	0.105^a	114.60^a	89.30^a	140.20^a
Po_3	5.54^a	-	5.56^a	0.076^a	-	0.106^a	112.15^a	-	134.80^a
Agria		5.40^a			0.117^a			89.75^a	
Initial Content	5.60	5.10	5.30	0.050	0.15	0.15	94.00	40.00	42.00
CV (%)	2.58	4.70	5.10	19.51	16.30	17.70	16.10	6.70	7.20

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 5. Potassium and sulfate contents of the soil as affected by different cultivars

Cultivar	Potassium (ppm)			Sulfate (ppm)	
	1998	1999	2001	1998	1999
Kennebec	516.45^a	437.60^a	458.25^a	21.41^{ab}	21.39^{ab}
Columbus	515.15^a	386.10^b	466.45^a	20.97^b	20.96^b
Po_3	478.10^a	-	475.00^a	23.07^a	-
Agria		443.80^a		-	23.06^a
Initial Content	50.00	76.00	50.00	31.50	25.10
CV (%)	13.92	12.10	8.90	13.29	5.90

Means in a column with the same letter are not significantly different at 5% level DMRT

Table 6. Growth and yield of potato as affected by different inorganic fertilizers containing sulfur

Inorganic Fertilizer	Height 70 DAP (cm)			Marketable yield (T/ha)			Non-marketable yield (T/ha)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
Control	57.50^b	36.47^b	49.56^b	8.32^c	14.10^b	18.11^a	1.14^a	1.84^a	1.00^b
21-0-0-24S	76.85^a	46.50^a	56.97^a	10.25^b	23.31^a	18.26^a	1.06^a	1.18^a	0.90^b
0-18-0-14S	60.88^b	38.82^b	53.61^a	8.16^c	21.26^a	17.03^a	0.67^{ab}	1.08^a	0.96^b
0-0-50-17.6S	61.23^b	40.14^a	54.97^a	11.95^a	21.66^a	14.84^a	0.49^{abc}	1.22^a	0.95^b
14-14-14-12S	75.35^a	42.35^a	56.30^a	9.91^b	22.36^a	16.06^a	0.71^{ab}	1.33^a	1.21^a
CV (%)	9.52	16.46	6.00	14.96	11.56	18.70	19.43	17.92	16.90

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 7. Chemical and physical analysis of potato tubers as affected by different inorganic fertilizers containing sulfur.

Inorganic fertilizer	DMC (%)			Sugar Content (^{0}Brix)			Specific Gravity (g)	Ash Content (%)
	1998	1999	2001	1998	1999	2001	2001	2001
Control	16.80^a	18.64^b	20.68^a	5.38^{ab}	5.16^b	5.78^a	1.082^a	6.15^a
21-0-0-24S	15.49^a	18.20^b	20.75^a	5.55^{ab}	5.55^{ab}	6.13^a	1.084^a	5.43^b
0-18-0-14S	16.27^a	18.31^b	20.53^a	5.23^{ab}	5.65^a	5.70^a	1.080^b	5.60^b
0-0-50-17.6S	17.21^a	19.53^a	20.78^a	5.40^{ab}	4.85^b	5.41^b	1.086^a	5.87^a
14-14-14-12S	15.95^a	18.30^b	20.66^a	6.22^a	6.03^a	6.08^a	1.081^{ab}	5.60^b
CV (%)	9.69	5.92	3.10	12.88	7.10	8.90	0.60	6.80

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 8. Chip qualities as affected by different inorganic fertilizers containing sulfur

Inorganic Fertilizer	Chips			
	Color	Texture	Crispiness	Flavor
Control	Light Yellow	Firm	Crispy	Slightly Perceptible
21-0-0-24S	Light Yellow	Firm	Crispy	Perceptible
0-18-0-14S	Light Yellow	Firm	Crispy	Perceptible
0-0-50-17.6S	Light Yellow	Firm	Crispy	Perceptible
14-14-14 12S	Light Yellow	Firm	Crispy	Perceptible

Table 9. pH, nitrogen and phosphorus contents of the soil as affected by different inorganic fertilizers containing sulfur.

Inorganic Fertilizer	pH			Nitrogen (%)			Phosphorus (ppm)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
Control	5.65^a	5.60^a	5.65^a	0.072^a	0.100^a	0.101^a	96.17^c	81.00^c	111.66^c
21-0-0-24S	5.21^b	5.30^b	5.36^b	0.080^a	0.106^a	0.105^a	102.92^{bc}	79.58^c	126.66^b
0-18-0-14S	5.64^a	5.65^a	5.73^a	0.078^a	0.108^a	0.104^a	112.50^{ab}	93.66^b	131.66^a
0-0-50-17.6S	5.70^a	5.63^a	5.70^a	0.077^a	0.113^a	0.102^a	103.42^{bc}	84.25^c	122.66^b
14-14-14 12S	5.27^b	5.30^b	5.45^{ab}	0.077^a	0.110^{a+}	0.104^a	118.42^a	100.33^a	136.75^a
Initial Content	5.60	5.10	5.30	0.05	0.15	0.15	94.00	40.00	42.00
CV (%)	2.58	4.70	5.10	19.51	16.30	17.70	16.10	6.70	7.20

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 10. Potassium and sulfate contents of the soil as affected by different inorganic fertilizers containing sulfur.

Inorganic Fertilizer	Potassium (ppm)			Sulfate (ppm)	
	1998	1999	2001	1998	1999
Control	404.83^c	382.83^c	385.66^c	13.71^c	13.69^d
21-0-0-24S	317.58^d	319.50^d	327.08^d	15.67^b	15.66^b
0-18-0-14S	436.83^c	382.83^c	397.33^c	47.88^a	47.87^a
0-0-50-17.6S	804.33^a	648.83^a	686.50^a	16.72^b	16.71^b
14-14-14 12S	552.58^b	451.16^b	536.41^b	15.09^b	15.08^c
Initial Content	50.00	76.00	50.00	31.50	25.10
CV (%)	13.92	12.10	8.90	13.29	5.90

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 11. Growth and yield of potato as affected by different cultivars and inorganic fertilizers containing sulfur

Treat-ments	Height 70 DAP (cm)			Marketable yield (T/ha)			Non-marketable yield (T/ha)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
C_1 F_0	49.53^{a}	36.67^{a}	36.05^{a}	8.33^{cdef}	18.40^{b}	12.79^{c}	1.10^{a}	1.96^{a}	0.61^{ef}
F_1	64.55^{a}	47.08^{a}	41.21^{a}	8.03^{def}	22.97^{ab}	15.68^{c}	1.10^{a}	0.89^{a}	0.66^{ef}
F_2	51.15^{a}	38.50^{a}	35.27^{a}	7.80^{ef}	20.20^{ab}	12.83^{c}	0.54^{a}	0.91^{a}	0.97^{d}
F_3	55.80^{a}	40.03^{a}	37.88^{a}	13.54^{a}	20.32^{ab}	13.33^{c}	0.63^{a}	0.95^{a}	0.85^{de}
F_4	64.60^{a}	40.20^{a}	39.99^{a}	10.57^{bc}	20.70^{ab}	13.37^{c}	0.80^{a}	0.98^{a}	0.88^{de}
C_2 F_0	47.80^{a}	40.96^{a}	39.16^{a}	7.33^{cdef}	23.83^{ab}	11.03^{c}	1.10^{a}	0.90^{a}	0.61^{ef}
F_1	68.40^{a}	54.06^{a}	47.16^{a}	10.24^{bcd}	28.66^{a}	15.89^{c}	1.07^{a}	0.63^{a}	0.43^{f}
F_2	49.55^{a}	44.44^{a}	45.55^{a}	8.60^{cdef}	27.66^{a}	16.17^{c}	0.44^{a}	0.64^{a}	0.52^{f}
F_3	48.20^{a}	46.11^{a}	45.16^{a}	9.90^{cde}	27.68^{a}	13.19^{c}	0.43^{a}	0.68^{a}	0.52^{f}
F_4	66.45^{a}	50.85^{a}	46.71^{a}	10.57^{bc}	29.04^{a}	12.79^{c}	0.63^{a}	0.99^{a}	0.83^{de}
C_3 F_0	75.53^{a}	31.80^{a}	73.49^{a}	9.30^{cdef}	15.06^{b}	18.50^{a}	1.23^{a}	2.67^{a}	1.77^{ab}
F_1	97.60^{a}	38.36^{a}	82.55^{a}	12.47^{ab}	18.43^{b}	23.19^{a}	1.00^{a}	2.03^{a}	1.59^{bc}
F_2	81.95^{a}	33.73^{a}	80.03^{a}	8.07^{def}	15.93^{b}	22.08^{ab}	1.00^{a}	1.69^{a}	1.37^{c}
F_3	79.70^{a}	34.29^{a}	81.88^{a}	12.40^{ab}	17.00^{b}	18.00^{bc}	0.40^{a}	2.04^{a}	1.46^{c}
F_4	95.00^{a}	36.20^{a}	82.21^{a}	8.60^{cdef}	17.37^{b}	22.03^{ab}	0.70^{a}	2.01^{a}	1.90^{a}
CV (%)	9.52	16.46	6.00	14.96	11.56	18.70	19.43	17.92	16.90

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 12. Chemical and physical analysis of potato tubers as affected by different cultivars and inorganic fertilizers containing sulfur

Treat-ments	DMC (%)			Sugar Content (^{0}Brix)			Specific Gravity (g)	Ash Content (%)
	1998	1999	2001	1998	1999	2001	2001	2001
C_1 F_0	16.80^{a}	19.30^{a}	19.40^{e}	4.60^{de}	4.90^{c}	5.45^{bcd}	1.070^{de}	5.76$^{bcd e}$
F_1	15.18^{a}	18.40^{b}	20.50^{bcd}	5.25^{bcde}	5.60^{b}	5.70^{bcd}	1.084^{b}	6.06^{bcd}
F_2	16.44^{a}	18.50^{a}	21.13^{ab}	4.35^{e}	5.20^{b}	5.45^{bcd}	1.090^{a}	6.82^{a}
F_3	16.64^{a}	20.30^{a}	20.20^{bcde}	5.85^{abc}	5.10^{bc}	5.10^{d}	1.088^{a}	5.68^{cdef}
F_4	16.20^{a}	17.90^{b}	19.53^{de}	6.15^{ab}	5.65^{b}	5.98^{abc}	1.073^{d}	5.51^{def}
C_2 F_0	16.40^{a}	18.70^{a}	21.66^{a}	5.75^{abcd}	6.15	5.60^{bcd}	1.089^{a}	6.20^{a}
F_1	15.88^{a}	18.30^{b}	20.80^{abc}	5.50^{bcd}	5.30^{b}	6.50^{abc}	1.088^{a}	5.09^{fg}
F_2	16.25^{a}	18.00^{b}	19.80^{cde}	5.80^{abcd}	6.05^{a}	5.45^{bcd}	1.070^{de}	5.26^{efg}
F_3	17.06^{a}	18.50^{a}	21.65^{a}	4.80^{cde}	4.38^{c}	5.35^{cd}	1.090^{a}	6.33^{ab}
F_4	16.40^{a}	19.90^{a}	20.80^{abc}	5.65^{bcd}	6.35^{a}	5.98^{abc}	1.088^{bc}	5.00^{fg}
C_3 F_0	17.20^{a}	17.90^{b}	21.00^{ab}	5.80^{abcd}	4.45^{c}	6.20^{abc}	1.089^{a}	6.00^{bcd}
F_1	15.43^{a}	17.90^{b}	20.96^{ab}	5.90^{abc}	5.75^{a}	6.60^{a}	1.082^{bc}	5.14^{efg}
F_2	16.13^{a}	18.50^{a}	20.66^{abc}	5.55^{bcd}	5.70^{a}	6.20^{abc}	1.080^{c}	4.72^{g}
F_3	17.94^{a}	19.80^{a}	20.26^{abcd}	5.55^{bcd}	5.10^{bc}	5.80^{abcd}	1.080^{c}	5.62^{def}
F_4	15.25^{a}	17.10^{b}	21.66^{a}	6.85^{a}	6.10^{a}	6.30^{ab}	1.082^{bc}	6.23^{abc}
CV (%)	9.69	5.92	3.10	12.88	7.10	8.90	0.60	6.80

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 13. Chip qualities as affected by different cultivars and inorganic fertilizers containing sulfur

Treatments	Chips			
	Color	Texture	Crispiness	Flavor
C_1 F_0	Yellow Cream	Fine Firm	Crispy	Slightly Perceptible
F_1	Yellow Cream	Fine Firm	Crispy	Perceptible
F_2	Yellow Cream	Fine Firm	Crispy	Perceptible
F_3	Yellow Cream	Fine Firm	Crispy	Perceptible
F_4	Yellow Cream	Fine Firm	Crispy	Perceptible
C_2 F_0	Light Yellow	Firm Coarse	Crispy	Slightly Perceptible
F_1	Light Yellow	Firm Coarse	Crispy	Perceptible
F_2	Light Yellow	Firm Coarse	Crispy	Perceptible
F_3	Light Yellow	Firm Coarse	Crispy	Perceptible
F_4	Light Yellow	Firm Coarse	Crispy	Perceptible
C_3 F_0	Light Yellow	Firm Coarse	Crispy	Slightly Perceptible
F_1	Light Yellow	Firm Coarse	Crispy	Perceptible
F_2	Light Yellow	Firm Coarse	Crispy	Perceptible
F_3	Light Yellow	Firm Coarse	Crispy	Perceptible
F_4	Light Yellow	Firm Coarse	Crispy	Perceptible

Table 14. pH, nitrogen and phosphorus contents of the soil as affected by different cultivars and inorganic fertilizers containing sulfur

Treatments	Soil pH			Nitrogen (%)			Phosphorus (ppm)		
	1998	1999	2001	1998	1999	2001	1998	1999	2001
C_1 F_0	5.60^{abc}	5.70^{abc}	5.70^{abc}	0.075^{a}	0.093^{a}	0.093^{ab}	74.75^{a}	69.25^{f}	80.50^{g}
F_1	5.23^{de}	5.35^{bcde}	5.42^{abc}	0.083^{a}	0.093^{a}	0.101^{ab}	104.00^{a}	77.25^{ef}	131.25^{d}
F_2	5.63^{abc}	5.57^{abcde}	5.60^{abc}	0.075^{a}	0.093^{a}	0.093^{ab}	90.00^{a}	91.25^{abc}	89.25^{fg}
F_3	5.65^{ab}	5.77^{ab}	5.77^{ab}	0.083^{a}	0.106^{a}	0.101^{ab}	96.00^{a}	96.00^{ab}	96.00^{f}
F_4	5.48^{bc}	5.42^{abcde}	5.60^{abc}	0.091^{a}	0.112^{a}	0.103^{ab}	101.75^{a}	87.50^{bcd}	116.25^{e}
C_2 F_0	5.63^{abc}	5.57^{abcde}	5.60^{abc}	0.075^{a}	0.093^{a}	0.106^{ab}	100.00^{a}	87.25^{bcd}	113.5^{e}
F_1	5.00^{f}	5.25^{de}	5.25^{c}	0.083^{a}	0.118^{a}	0.126^{a}	112.00^{a}	87.25^{bcd}	137.25^{cd}
F_2	5.63^{abc}	5.80^{a}	5.87^{a}	0.075^{a}	0.118^{a}	0.106^{ab}	125.25^{a}	92.25^{abc}	158.50^{a}
F_3	5.75^{a}	5.62^{abcd}	5.67^{abc}	0.066^{a}	0.106^{a}	0.097^{ab}	109.00^{a}	79.50^{cd}	138.50^{cd}
F_4	5.10^{ef}	5.32^{cde}	5.37^{bc}	0.066^{a}	0.100^{a}	0.091^{b}	126.75^{a}	100.25^{a}	153.50^{ab}
C_3 F_0	5.73^{a} 5.65^{abc}		5.52^{abcde}	0.066^{a}	0.112^{a}	0.103^{ab}	113.75^{a}	86.50^{bc}	141.25^{bcd}
F_1	5.40^{cd}	5.32^{cde}	5.42^{abc}	0.075^{a}	0.106^{a}	0.093^{b}	92.75^{a}	74.25^{ef}	111.50^{e}
F_2	5.65^{ab} 5.70^{abc}		5.60^{abcd}	0.083^{a}	0.118^{a}	0.113^{ab}	122.25^{a} 147.25^{abc}		97.50^{a}
F_3	5.70^{ab} 5.65^{abc}		5.50^{abcd}	0.083^{a}	0.125^{a}	0.107^{ab}	105.25^{a}	77.25^{ef}	133.50^{cd}
F_4	5.23^{de}	5.15^{e}	5.37^{bc}	0.075^{a}	0.118^{a}	0.118^{ab}	126.75^{a} 140.50^{bcd}		113.25^{a}
Initial Content	5.60	5.10	5.30	0.05	0.15	0.15	94.00	40.00	42.00
CV (%)	2.58	4.70	5.10	19.51	16.30	17.70	16.10	6.70	7.20

Means in a column with the same letter are not significantly different at 5% level DMRT.

Table 15. Potassium and sulfate contents of the soil as affected by different cultivars and inorganic fertilizers containing sulfur

Treatments	Potassium (ppm)			Sulfate (ppm)	
	1998	1999	2001	1998	1999
C_1 F_0	374.00^{a}	338.00^{efg}	345.00^{cd}	14.38^{ef}	14.37^{fgh}
F_1	318.75^{a}	327.50^{fg}	330.25^{d}	15.55^{e}	15.53^{efg}
F_2	474.50^{a}	415.00^{cdef}	401.50^{c}	49.52^{b}	49.50^{b}
F_3	826.50^{a}	625.50^{b}	682.00^{a}	14.11^{ef}	14.10^{gh}
F_4	588.50^{a}	482.00^{c}	532.50^{b}	13.48^{ef}	13.47^{gh}
C_2 F_0	443.25^{a}	389.00^{def}	401.25^{c}	12.86^{ef}	12.85^{h}
F_1	324.00^{a}	333.50^{fg}	325.50^{d}	16.39^{e}	16.38^{ef}
F_2	429.25^{a}	364.50^{efg}	383.75^{cd}	41.18^{c}	41.17^{c}
F_3	803.25^{a}	596.50^{b}	674.75^{a}	19.35^{d}	19.34^{d}
F_4	576.00^{a}	247.00^{cd}	547.00^{b}	15.06^{e}	15.05^{efg}
C_3 F_0	397.25^{a}	421.50^{cde}	410.75^{c}	13.88^{ef}	13.87^{gh}
F_1	310.00^{a}	297.50^{g}	325.50^{d}	15.08^{e}	15.07^{efg}
F_2	406.75^{a}	369.00^{efg}	406.75^{c}	52.95^{a}	52.94^{a}
F_3	783.25^{a}	724.50^{a}	702.75^{a}	16.71^{e}	16.70^{e}
F_4	493.25^{a}	406.50^{cdef}	529.75^{b}	16.73^{e}	16.72^{e}
Initial Content	50.00	76.00	50.00	31.50	25.10
CV (%)	13.92	12.10	8.90	13.29	5.90

Means in a column with the same letter are not significantly different at 5 % level DMRT

Potato*
(One Hectare)

1. Cost of Production

A. Labor Cost

Activity	Man-Days	Value (P)
1. Land preparation and fertilizer application	110 @ P180/day	19,800.00
2. Seed pieces preparation and planting	33	5,940.00
3. Care and maintenance		
Irrigation (10 times)	50	9,000.00
Hilling-up/weeding	38	6,840.00
Spraying	60	10,800.00
4. Harvesting		
Digging	20	3,600.00
Sorting/Packing	30	5,400.00
Hauling	6	1,080.00
SUB-TOTAL	347 DAYS	62,460.00

B. Cost of Inputs

1. Tuber seeds (2,500 kg @ P25.00/kg)	62,500.00
2. Pesticides	
a. Curzate (36 kg @ P500.00/kg)	21,600.00
b. Dimotrin (6L @ P600/li)	3,600.00
c. Trigard (3 kg @ P6,000/kg)	18,200.00
3. Red bags (1,000 pcs @P7.00/pc)	7,000.00
4. String/straw (2 rolls @ P50.00/roll)	100.00
SUB-TOTAL	113,000.00

C. Fixed Cost

1. Land rental (P12.00/square meter/yr. 4 cropping season	25,000.00
Depreciation of tools	3,000.00
SUB-TOTAL	28,000.00

* = Modified from Benguet Potato Technoguide (1976), cost of labor and inputs were based on 2000 prices.

D. Fertilizers

Item	Chicken dung (control)	Ammonium Sulfate	Ordinary Superphosphate	Potassium Sulfate	Triple-14
Chicken dung	8,000	8,0000	8,000	8,000	8,000
Sulfur Source		11,927	5,414	3,600	9,639
Sub-Total	8,000	11,927	13,414	11,600	17,639
Total Cost of Production	**211,460**	**215,387**	**216,874**	**215,060**	**221,099**

II. Economic Analysis

Gross Returns

Class	Weight of Potato Tubers (kg)					Price /kg
Extra large (100g) 15%	2,026.50	2,590.95	2,322.45	2,422.50	2,416.50	25.00
Large (80-90g) 50%	6,755.00	8,636.50	7,741.50	8,075.00	8,055.00	20.00
Medium (50-79g) 25%	3,377.50	4,318.25	3,870.75	4,037.50	4,027.50	15.00
Small (40-49g) 10%	1,351.00	1,727.30	1,548.30	1,615.00	1,611.00	10.00
Marketable yield (kg/ha)	13510.00	17273.00	15483.00	16150.00	16110.00	
Non-marketable yield (t/ha)	1,320.00	1,040.00	900.00	880.00	1,080.00	
Total Yield (t/ha)	14850.00	18313.00	16383.00	7030.00	17190.00	

Extra Large	50,662.50	64,773.75	58,061.25	60,550.00	60,412.50
Large	135,100.00	172,730.00	154,830.00	161,500.00	161,100.00
Medium	50,662.50	64,773.75	58,061.25	60,562.50	60,412.50
Small	13,520.00	17,273.00	15,483.00	16,150.00	16,110.00
Total Gross Returns	249,935.00	319,550.50	286,435.50	314,912.50	281,941.11
Net Income	38,475.00	104,163.50	69,561.50	99,852.50	60,842.11

$$ROI = \frac{\text{Net Income}}{\text{Total Cost of Production}} \times 100$$

18.19%	48.36%	32.07%	46.43%	27.51%