COMPARATIVE STUDY OF DIFFERENT LEVELS OF INORGANIC FERTILIZERS ON RADISH PRODUCTION

Clemencia L. Sumagaysay,Ph.D.

Abstract

A comparative study of different levels of inorganic fertilizers on radish production *Raphanus sativus*production was conducted at the Demonstration Field area of Surigao del Sur State University (SDSSU), Tagbina, Surigao del Sur during the wet season last 2003. Results revealed a highly significant difference on tuber length, tuber weight and tuber yield of radish. This result conform with the report of Stover and Simmonds (1987) that the most important aspect of soil is to maintain adequate levels of fertilization of nitrogen and potassium and the correct balance between the cations (K, Ca, Mg). The recommended rate T_3 (3.15-48-42) of NPK fertilizer produced the highest yield of radish tubers. Although T_2 (recommended rate 21-32-28) obtained the highest tuber weight and tuber length but it did not significantly differ from the plant applied with T_3 of NPK fertilizer. Results further stated that there is no significant difference on plant height; number of leaves and tuber diameter.

Keywords: Inorganic fertilizer, Tuber, diameter

Introduction

Soil fertility is one of the major factors to be taken into consideration for proper growth and development of crops(Cagmat et al., 1985). Even with good soil mixture continuous growth of plants in containers necessitates the addition of an interval of supplementary minerals, especially, of the three major elements-nitrogen, phosphorus and potassium (Hartman and Kester, 1975). The production of radish *Raphanus sativus*in Tagbina is limited due to the nutrient content of soil. PCARRD (1998) revealed that the final amount of fertilizer to apply is determined by the nutrient supply in the soil and the amount available nutrient on soil determined yield responses to the applied fertilizers. Generally the soil pH of Tagbina is acidic and this is one of the reasons radish could not produced its optimum yield.

One of the most popular root crops in the Philippines is radish. It is one of the easiest and quickest vegetable to grow giving a yield of root crops with minimum effort. It is an annual herb with stalked hairy leaves, the lower ones with margins divided into a featherlike fashion. The flowers are white to light purple and are borne on elongated branched stalks. The beaked pod (fruit), 2 to 7 cm long, are spongy and are constituted between the seeds

The roots can be harvested 40 to 60 days after the seeds are planted. Radish is a good source of iron, calcium and vitamin B.

Radish has many uses. It is grown for its appetizing flavor. It can be eaten raw as salad, or it can be cooked with meat or fish. It is also used as pickles or preserved as in" buro", a Filipino delicacy.

Radish refers a fairly wide climatic and soil adaptation. The optimum pH for radish is 5.0 – 7.0. It grows well on fertilized soil and good drainage. Sandy loams and fisable loam are best for commercial production.

Nutrition, an essential factor in plant growth should be emphasized in the production of radish in order to obtain optimum yield and high quality produce (PCARRD, 1998). Studies show that fertilizer application improves both vegetative and reproductive performance of crucifers. Radish needs nitrogen , phosphorus, and potassium for optimum growth; hence this study was conducted.

Objectives

1. To evaluate the growth and yield performance of radish as influenced by the different levels of NPK fertilizers
2. To determine the right amount of NPK that would give the optimum production of radish.

Materials and Methods

Place and Time of the Study

This study was conducted at SDSSU Experimental Area during wet season, 2003 atTagbina, Surigao del Sur.

Soil Sampling and Analysis

Soil sampling was done before land preparation. Soil samples were collected at random, composited and air dried, and sent for analysis at the Bureau of Soil and Testing Laboratory, Butuan City. The soil samples were analyzed for pH, N, P and K contents and served as basis for assigning fertilizer level treatment.

Land Preparation

The area was plowed and harrowed three times at one week interval. Plowing was done when the soil moisture was just right (not too wet and not too dry) followed by harrowing to keep the soil well pulverized and ready for planting.

Experimental Design and Treatment

A Randomized Complete Block Design (RCBD) was used in this study with four treatments and replicated three times. The treatments were:

T_1 = Control

T_2 = Recommend rate (21-32-28)

T_3 = Above recommended rate (31.5-48-42)

T_4 = Below recommended rate (10.5-16-14)

Treatments were based on soil analysis. All the data gathered were subjected to analysis of variance in CRD at 5% and 1% levels of significance.

Field Layout

Each plot consisted of four rows spaced at 20 cm and 2 m long. One half (1/2) meter alley was provided between replication.

Planting and Thinning

A hybrid seed of radish was sown in the furrows of plot at a distance of 20 cm between furrows. Thinning was done one week after sowing, leaving one plant per 5 cm per hill.

Application of Fertilizer

Split application of fertilizer was done at the level/rate started in the treatments. One third (1/3) of mixed NPK was applied basally per treatment. The remaining amount of NPK per treatment was side dressed twice, one week after thinning (1/3) and 14 days interval after the first side dressing (1/3).

Weeding and Cultivation

Weeding was done as soon as weeds to appear on the beds and after the young plants developed two pairs of leaves. Cultivations was done from time to time until the plants were large enough to cover the ground thus minimizing/controlling the growth of weeds.

Watering

Watering was done at least once a week. Watering was continued until the plants were harvested to make the roots tender, crisp and sweet.

Pest and Diseases

Insect pest was controlled by basal application of Furadan granules. Other diseases were controlled and prevented using certified seeds, strict sanitation and a follow up with fungicide.

Harvesting

Radish harvested 60 days after sowing, from March – April, 2003. The harvested tubers washed thoroughly under running water until all the soil was removed. Tubers were then weighted to get the number of kilos per plot**.**

Data Gathered

Plant Height (cm)

Plant height was determined by measuring the 10 sample plants from the ground level up the tip of the longest leaf.

Number of Leaves

Number of leaves was counted once a week after thinning.

Length of Tuber (cm)

Length of the tubers was done by measuring the tubers of 10 sample plant from the butt to the tip.

Diameter of Tuber

Diameter of tuber was done by measuring the broadest portion of the tuber using a Bernier caliper.

Weight of tubers (kg)

Weight of tuber was determined by weighing all the tubers of all sample plants per plot.

Yield of Tubers

Yield of tuber was expressed into per hectare by using the following formulation.

$$\text{Tuber yield} = \frac{\text{Plot yield/kg}}{10{,}000 \text{ kg/ton}} \times \frac{10{,}000 \text{sq.m./ha.}}{\text{Plot area}}$$

Results and Discussion

Plant Height of Radish

Table 1.0 Average plant height (cm) of radish plants as affected by the different levels of NPK fertilizers.

Treatment	REPLICATION I	II	III	Total	Mean
T_1	20.35	19.79	21.92	62.06	20.69
T_2	21.67	22.19	20.15	64.01	21.34
T_3	19.50	20.34	19.66	59.50	19.83
T_4	20.97	24.10	19.54	64.61	21.54
Mean	**20.62**	**21.60**	**20.32**		

Result of Radish height as affected by different levels of NPK is shown in Table 1.0. Generally, the radish applied with T_4 was observed the tallest plant with a mean height of 21.54 cm, while the shortest measurement was taken from plant applied with T_3 of NPK fertilizer.

Result on the analysis of variance on plant revealed no significant effect on the treatment and replication.

The tallest height obtained by plants applied T4 (10.5- 16- 14) confirmed that the soil contained enough amount of essential elements for plant nutrition, but because of continuous growth of plants, the addition of intervals supplementary minerals, especially the three major elements – nitrogen, phosphorous and potassium is needed

Number of Leaves

Table 2.0 Average number of leaves of radish plants as affected by the different levels of NPK fertilizers.

Treatment	REPLICATION I	II	III	Total	Mean
T_1	11.50	10.70	11.30	33.50	11.17
T_2	10.00	11.60	9.30	30.90	10.30
T_3	9.60	10.00	8.40	28.00	9.33
T_4	11.70	10.90	8.40	31.00	10.33
Mean	**10.70**	**10.80**	**9.35**		

Results on the analysis of variance revealed that there were no significant effects on the number of leaves applied with the different levels of leaves applied with the different levels of NPK fertilizers.

It further shows in Table 2.0 that the highest number of radish leaves was achieved by plant without the application of NPK fertilizer, while T_3 (31.5- 48-42) above the recommended rate has the lesser number of leaves. Result revealed that at maturity, the number of leaves decreases because the nutrient of plant is translocated and utilized for the development of tubers.

Tuber Length

Table 3.0 Average tuber length (cm) of radish as affected by the different levels of NPK fertilizers.

Treatment	REPLICATION I	II	III	Total	Mean
T_1	12.81	11.62	11.07	35.50	11.83_{bcd}
T_2	14.96	13.43	13.75	42.14	14.05_{b}
T_3	15.60	13.65	11.88	41.13	13.71_{bc}
T_4	15.93	16.15	13.62	45.70	15.23_{a}
Mean	**14.82_{a}**	**13.71_{b}**	**12.58_{bc}**		

Tuber lengths (cm) of radish evaluated after harvesting are presented in Table 1.0. Plant applied with T_4 (10.5-16-14) below recommended rate of NPK fertilizer produced the longest tuber with a mean of 15.23 cm of 15.23 cm while the shortest length of tuber was produced by plants applied with zero or no NPK fertilizer application. Further, results indicated a significant effect on increased length of radish tuber yield. As stated by Villegas, L. M. (1979) phosphorous is involved in growth and reproduction. It is necessary for metabolic processes of many plants. It keeps the plant cells in a turgid condition, strengthens straw and stalk of plants and improves the quality of fruits.

Furthermore, result revealed a highly significant effect between the four levels of NPK fertilizers and on the replication.

The significant effect on the block was probably due to the unequal NPK concentrations in the soils and exposure to light, and other unexplained micro environment factors.

Tuber Diameter

Table 4.0 Average tuber diameter (cm) of radish as affected by the different levels of NPK fertilizers.

Treatment	REPLICATION			Total	Mean
	I	II	III		
T_1	4.12	4.30	4.21	12.63	4.21
T_2	4.33	5.05	4.70	14.08	4.69
T_3	4.14	5.07	4.53	13.74	4.58
T_4	4.70	4.55	4.28	13.53	4.51
Mean	**4.32**	**4.74**	**4.43**		

Table 4.0 shows the diameter (cm) of radish tuber evaluated after harvesting. The biggest tuber diameter was obtained in plants applied with T_2 (21- 32- 28) of NPK fertilizer, and the smallest was found in plants without the application of NPK fertilizers.

It was observed that the diameter of radish tuber showed no significant effect of the NPK fertilizer application.

Tuber Weight

Table 5.0 Mean Weight (kg) of radish tubers as affected by the levels of NPK fertilizers.

Treatment	REPLICATION			Total	Mean
	I	II	III		
T_1	1.35	1.35	1.15	3.85	1.28_{abcd}
T_2	1.65	1.90	1.60	5.15	1.72a
T_3	1.70	1.90	1.35	4.95	1.65_{ab}
T_4	1.85	1.75	1.35	4.95	1.58_{abc}
Mean	$\mathbf{1.64_{ab}}$	$\mathbf{1.72_{a}}$	$\mathbf{1.36_{c}}$		

Table 5.0 presents the weight of ten radish tubers. Results show a high significant effect of the different levels of NPK fertilizer on tuber weight of radish plants. It was observed that T_4 (10.5-16–14) of NPK fertilizer produced the heaviest tuber with a mean of 1.72 kilogram while plants applied without NPK fertilizer gave the lighter radish tuber with a mean of 1.28 kilograms.

The corresponding increase in the weight of radish tuber was due to the favorable effect of the right levels of NPK fertilizer. Continued application NPK fertilizer up to the reproductive stage provided adequate supply of the elements which is essential for upper tuber development.

Tuber Yield

Table 6.0 Yield (ton/ha) of radish tubers as affected by the different levels of NPK fertilizers.

Treatment	REPLICATION I	II	III	Total	Mean
T_1	9.10	9.10	8.68	26.87	8.96_{bcd}
T_2	8.92	10.42	9.72	29.06	9.69_{bc}
T_3	11.11	11.75	12.23	35.09	11.70_{a}
T_4	8.78	11.91	10.42	31.11	10.37_{b}
Mean	**9.48_{c}**	**10.80_{a}**	**10.26_{c}**		

Table 6.0 shows the tuber yield data of radish in tons per hectare. Analysis of Variance showed a highly significant effect among the different levels NPK fertilizer.

Result revealed that T_3 (31.5- 48 – 42) of NPK fertilizer application produced the highest yield of radish tuber with a mean of 21.06 tons per hectare and T_1 (control) or without NPK fertilizer application whose mean is 16.12 tons per hectare produced the lowest tuber yield of radish.

The significant yield increase of T_3 (31.5–48–42) of NPK fertilizer application is an indication that continued supply of right amount/level of NPK fertilizer improves growth of radish. Improved growth resulted to longer tuber length increase in weight of tuber and appreciable tuber yield.

Furthermore, results favorably endorse the findings of PCARRD (1998) that knowledge of the efficiency of nutrients uptake helps determine the most effective rate of fertilizer to be applied.

Summary and Conclusion

This study was conducted to (1) evaluate the growth and yield performance of radish as influenced by the different levels of NPK fertilizers (2) determine the right amount of NPK that would give the optimum production of radish.

The results are summarized as follows:

1. Response of radish to different levels of NPK fertilizer application observed highly significant on tuber yield. The above recommendation (31.5 – 48 – 42) of NPK fertilizer produced the best measurement in most of the parameters. It obtained a mean of 21.06 tons per hectare.
2. Different levels of NPK fertilizers significantly influenced length tubers, so with its weight and yields.

3. Treatments of different levels of NPK fertilizer showed no effect on plant height, number of leaves and tuber diameter of radish.

Moreover, out of the four treatment of NPK fertilizer application. Treatment three (3) T_3 (31.5 – 48 – 42) rate of NPK fertilizer appeared to be the right amount/level to optimize radish production.

Recommendation

Similar studies shall be conducted again in other localities to determine the effects of the right amount /level of NPK fertilizers on the production of radish. Since the study was conducted during rainy days/season, a comparative study during dry seasons is also recommended.

Moreover, although this is only a basic study, its results can be used in the field as benchmark information for conducting applied research.

Literature Cited

Blanc, R, Ambrosio. 1981. Agricultural Research Management in Ilocos Agriculture Research Center. Mariano Marcos State University, Batac Ilocos Norte. Pp38.

Brazilian Agriculture and Agricultural Research, Brasilia, 1974. Embrapa Dep. Documentos 9, pp.307.

Gracia L. B. & Lana, De Ruth, 1984. Livelihood Seris Crop Production. Lanaprints. 375 J. Rizal St., Mandaluyong Metro Manila. Pp.74-77.

Lantican, Ricardo M. 2001.The Science and Practice of Crop Production. Seameo Sarca & UPLB, College, Los Baños, Laguna, Philippines.

Oliva, L.P., Burgos, N.R. and Etc. Diagnostic Survey: An Introduction to OFRO in Cotabato, Philippines. Vol. 2 No. 1 1990.

PCARRD, Farmnews Vol. XXII, November – December 1997. Growing Vegetable When Water is Scarce pp. 32.

PCARRD. Philippines Recommends for vegetable Crops. 1998.

PCARRD. Philippines Recommends for vegetable Crops. 1975.

Sangatanan, P.D. and Sangatanan, R.I. 1990. Soil Management. Rex Book Store 856 Nicanor Reyes, Sr. St. pp. 273