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# Growth and Yield of Sweet Potato (*Ipomea batatas*) Applied with Different Levels of NPK under Siasi, Sulu Condition

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## Abstract

The study was conducted to determine the growth and yield of sweet potatoes applied with different levels of complete fertilizer (NPK). It aimed to determine which varying amounts of the complete fertilizer would give the highest expected results. This study was conducted in an area of 875 square meters located at Tulling, Siasi, Sulu. Each treatment was replicated four times to fit a randomized complete block design (RCBD). It was observed that there was a significant difference among treatment means. The findings indicated that complete fertilizer (NPK) at the rate of 45kgs/ha produced the highest yield and gave better growth performance compared to 35kgs/ha and 25kgs/ha. NPK enhances the growth and increases the yield of sweet potatoes. Proper care and management should also be strictly observed to prevent intervening variables from adversely affecting the growth and yield of sweet potatoes.

**Keywords:** Growth of sweet potato, Yield of sweet potato, Levels of NPK application, Siasi, Sulu Condition

## 1. Introduction

Globally, there has been an increase in the production and productivity of sweet potato. India and China are the top producers of this crop, with India producing 91.1 million tons and China producing 81.2 million tons (FAOSTAT, 2010).

Sweet potato is a perennial dicotyledon, but it is cultivated as an annual for vines and storage roots. Sweet potato belongs to a single species, *Ipomea batatas* (L) Lam. The sweet potato and closely related species are classified in the family *convolvulaceae* (morning glory), as, subgenus, *eriospermum*, section *Eriospermum* (formerly Batatas) and series Batatas . It has a funnel-shaped flower 3/4 to 1 1/2 inches long. The flower usually have rope-violet or bulks petal with a darker color in the throat. Each flower has five stamen and subdivided style, one to four black flattened seeds are borne in each fertile capsule, nearly or plants are self-fertile (Austin and Huaman, 1996 as cited by Okafor, 2015).

The sweet potato is a significant root and tuber crop cultivated in tropical and subtropical regions such as China, the United States, India, Japan, the Philippines, Indonesia, Thailand, Vietnam, and Nigeria, among others. Sweet potato is the second most cultivated root and tuber crop globally, following cassava (Ray & Ravi, 2005).The primary mode of consumption of this food item is in the form of tubers, which are typically prepared through boiling or roasting over an open flame (Chipungu, 2008).

In contemporary times, there has been a decline in the production rate of sweet potato, despite its multifaceted economic and nutritional benefits. The reduction in yield of sweet potato can be primarily attributed

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to a decline in soil nutrient status. Organic manure has been found to have a beneficial effect on both the soil and crop, however, its bulkiness, slow release of nutrients, and difficult handling present significant challenges, particularly in commercial production. Despite its relatively high cost, inorganic fertilizer is a preferable option for commercial production due to its rapid nutrient release and ease of handling. Moreover, sweet potato is a crop with a short growth cycle that necessitates the use of inorganic fertilizers to expedite the release of nutrients in the soil for efficient plant utilization. Hence, the utilization of inorganic fertilizers is highly probable to enhance crop productivity.

The farmers in Siasi, Sulu exhibit a preference for cultivating sweet potato crops. However, their limited understanding of the optimal application of nitrogen, phosphorus, and potassium (NPK) has led to suboptimal yield production and stunted growth performance. The purpose of this research was to assist farmers in the area by exploring the effects of various levels of complete fertilizer application on sweet potato yield. Complete fertilizer was chosen due to its affordability and accessibility.

## 2. Methods

The study used an experimental research approach to acquire the necessary information on the growth and yield of sweet potato (*Ipomea batatas*) applied with different levels of NPK. Experimental research involves conducting a comparative analysis wherein the researcher examines two or more variables and observes a group of individuals under a specific condition or groups that are exposed to varying conditions. Through the evaluation of outcomes derived from this particular investigation, scholars can establish associations among the utilized variables and their impacts on every cohort. Experimental research employs the scientific method to identify optimal approaches for achieving a task or delivering a service (Indeed, 2023).

### *2.1 Locale*

The study was conducted from September 18, 2020 to January 28, 2021 located at Tulling, Siasi, Sulu. Tulling is a locality situated in the barangay of Siasi, which is located in the province of Sulu. The population of the area was recorded as 3,133 according to the 2020 Census. This constituted 3.84% of the entire populace of Siasi. Tulling is located at the geographical coordinates of approximately 5.5771 latitude and 120.8379 longitude, on the island of Siasi (PhilAtlas, 2023).

### *2.2 Land Preparation*

The experimental site was prepared by removing all vegetation and debris through the process of cutting. Subsequently, the site was subjected to two rounds of plowing, spaced three days apart. The field was then furrowed for the final field operation.

### *2.3 Field Lay-out*

After furrowing was performed the area was equally divided into four blocks. Each block represented a replication, and this was further subdivided into plots which represents treatments. Treatment I without application of the complete fertilizer, Treatment II was applied with complete fertilizer at the rate of 25 kilograms per hectare, Treatment III was applied with complete fertilizer at the rate of 35 kilograms per hectare and Treatment IV was applied with complete fertilizer at the rate of 45 kilograms per hectare.

### *2.4 Preparation of the Planting Materials*

The cuttings were secured from healthy stocks of sweet potato gathered from the nearby farm. The terminal portions of the cuttings were selected. The leaves of the cuttings were cut-off to prevent evaporation and to

induce root formation. The cuttings were selected. The leaves of the cuttings were bundled and arranged in upright position. The cuttings were regularly cut at about 45 centimeters long with at least 4 inter nodes.

### *2.5 Planting*

The cultivars were planted at a height of 25 to 30 centimeters in the ridges. There is a greater advantage in planting on ridge because it enhances good operation and encourages tuber development. About a two-third of the cuttings were buried in the soil.

### *2.6 Distance of Planting*

The vine cuttings were spaced at a distance of 75 centimeters between hills and 75 between rows. There were 768 hills planted to every treatment. The total plant density of the area was 1,536 hills with three vine cuttings per hills.

### *2.7 Application of Fertilizer*

Complete fertilizer was used in the study according to treatments. Treatment I without application of the complete fertilizer, Treatment II was applied with complete fertilizer at the rate of 25 kilograms per hectare, Treatment III was applied with complete fertilizer at the rate of 35 kilograms per hectare and Treatment IV was applied with complete fertilizer at the rate of 45 kilograms per hectare. The first application of fertilizer was done through side-dressing during planting. The second fertilization procedure involved the dissolution of one tablespoon of NPK in four liters of water. The solution was sprinkled to the plants in the afternoon three weeks after planting.

### *2.8 Weeding and Cultivation*

Weeding was done as soon as the weeds appeared on the fields. Weeds competed with the creeping plants for soil moisture and nutrients. The base of the plant were hill up to three weeks from planting when the vines have not yet grown towards the center of the rows. Weeding was done several times as the need arises while cultivation was done twice during the entire period of the study.

### *2.9 Control of Pests and Diseases*

In order to prevent the infestation of insect pests and disease, Thiodan was sprayed to the plants. The rate of the application was two tablespoonful of the chemical per container of water and the solution was evenly sprayed to the plants. Spraying was done four times at one week interval. Because of this preventive measure, the plants in every treatment remained vigorous until harvest time.

### *2.10 Weighing*

The samples from the treatments were separately weighed. A weighing scale balance was used for the purpose.

### *2.11 Harvesting*

The harvesting process was initiated after 120 days of planting, upon the manifestation of maturity signs in the plants, which were characterized by the yellowing of their leaves. Harvesting was done using a working bolo to dig out the tubers in every hill. The tubers were separately kept according to treatments to avoid mixing of the data gathered.

### *2.12 Data Gathered Analysis*

1. Actual yield in kilogram per treatment
2. Average number of tubers per sample hill per treatment
3. Average length of tuber in centimeter per 42 representative samples per treatment

## 3. Results and Discussions

Table 1 shows the actual yield and kilogram per treatments, Treatment IV has a greater mean of 10.425 kilograms, while Treatment III ranked with a mean of 9.375 kilograms, Treatment II with a mean of 8.52 kilograms, and Treatment I with the lowest which has no application of the complete fertilizer with a mean of 7.805 kilograms.

**Table 1** Actual yield in kilogram per treatment

| No. of Treatment | REPLICATION | | | | TOTAL | MEAN |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Treatment I | 7.50 | 7.85 | 8.25 | 7.62 | 31.22 | 7.805 |
| Treatment II | 8.95 | 8.33 | 8.70 | 8.10 | 34.08 | 8.52 |
| Treatment III | 9.55 | 9.29 | 9.46 | 9.20 | 37.50 | 9.375 |
| Treatment IV | 10.65 | 10.92 | 10.37 | 9.76 | 41.70 | 10.425 |
| **Block Total** | **36.65** | **36.39** | **36.78** | **34.68** | | |
| **Grand Total** | | | | | **144.5** | |
| **Grand Mean** | | | | | | **9.03125** |

Table 2 shows the analysis of variance (ANOVA) based from the result. Treatment was highly significant at 5% level while block revealed not significant both 5% and 1% of significant. The Observed F value of treatment 53.525 at 5% level and 1% level of significant.

**Table 2** Analysis of Variance

| Source of Variation | Degree of Freedom | Sum of Square | Mean of Square | Observed F | Tabular F | |
|---|---|---|---|---|---|---|
| | | | | | 5% | 1% |
| Treatment | 3 | 15.303 | 5.1010 | 53.525** | 3.86 | 6.99 |
| Block | 3 | 0.715 | 0.2385 | 2.502 ns | 3.86 | 6.99 |
| Ept'l error | 9 | 0.858 | 0.0953 | | | |
| **Total** | **12** | **16.876** | | | | |

**Result**: Treatment - Highly Significant**
Replication - Not Significant (ns)

Table 3 shows the average number of tubers per sample hill per treatment. Treatment IV got the highest mean of 8.21, Treatment III ranked second with a mean of 7.36, Treatment II with a mean of 7.03 and Treatment I with the lowest mean of 5.19.

**Table 3** Average number of tubers per sample hill per treatment

| No. of Treatment | REPLICATION | | | | TOTAL | MEAN |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Treatment I | 5.0 | 6.09 | 4.25 | 5.12 | 29.77 | 5.19 |
| Treatment II | 8.0 | 5.10 | 8.81 | 6.92 | 28.15 | 7.03 |
| Treatment III | 8.0 | 7.44 | 8.39 | 9.71 | 29.47 | 7.36 |
| Treatment IV | 9.0 | 8.98 | 6.94 | 9.11 | 32.86 | 8.21 |
| **Block Total** | **30.0** | **31.0** | **32.0** | **32.0** | | |
| **Grand Total** | | | | | **125.0** | |
| **Grand Mean** | | | | | | **7.8125** |

As shown in Table 4, the analysis of variance shows that highly significant at 5% level and 1% level of significant the Observed F value for treatment is 8.0695 which is more than the tabulated F value of 3.86 and 6.99 under 5% and 1% level of significant.

**Table 4** Analysis of Variance

| Source of Variation | Degree of Freedom | Sum of Square | Mean of Square | Observed F | Tabular F | |
|---|---|---|---|---|---|---|
| | | | | | 5% | 1% |
| Treatment | 3 | 21.688 | 7.229 | 8.0695** | 3.86 | 6.99 |
| Block | 3 | 0.688 | 0.229 | 0.2557 ns | 3.86 | 6.99 |
| Ept'l error | 9 | 0.062 | 0.896 | | | |
| **Total** | **12** | | | | | |

Result: Treatment - Highly Significant**
Replication - Not Significant (ns)

Table 5 indicates the average length of tuber in centimeter per 42 representative samples per treatment. The results indicate that Treatment IV produced the longest tubers with a mean of 17.78 centimeters. Treatment III followed with a mean of 17.23 centimeters, while Treatment II ranked third with a mean of 16.42 centimeters. Treatment I, which did not receive the complete fertilizer application, had the lowest mean of 15.28 centimeters.

**Table 5** Average length of tuber in centimeter per 42 representative samples per treatment

| No. of Treatment | REPLICATION | | | | TOTAL | MEAN |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Treatment I | 14.60 | 15.26 | 15.39 | 15.90 | 61.15 | 15.28 |
| Treatment II | 16.71 | 16.25 | 16.56 | 16.15 | 65.67 | 16.42 |
| Treatment III | 17.67 | 17.34 | 17.15 | 17.76 | 68.67 | 17.23 |
| Treatment IV | 18.10 | 18.62 | 17.90 | 16.83 | 71.15 | 17.78 |
| **Block Total** | **67.08** | **67.00** | **67.00** | **65.64** | | |
| **Grand Total** | | | | | **266.89** | |
| **Grand Mean** | | | | | | **16.6775** |

The data in the table 6 presents the analysis of variance which indicates that there is an apparent difference on the length of tubers produced among treatments as the Observe F value for treatment is 17.584 which is more than the Tabular F value of 3.86 and 6.99 under 5% and 1% levels of significance respectively.
The difference is due to the sufficient application of complete fertilizer especially in Treatment IV.

**Table 6** Analysis of Variance

| Source of Variation | Degree of Freedom | Sum of Square | Mean of Square | Observed F | Tabular F | |
|---|---|---|---|---|---|---|
| | | | | | 5% | 1% |
| Treatment | 3 | 14.148 | 4.716 | 17.584** | 3.86 | 6.99 |
| Block | 3 | 0.394 | 0.131 | 0.489 ns | 3.86 | 6.99 |
| Ept'l error | 9 | 2.415 | 0.268 | | | |
| **Total** | **12** | | | | | |

Result: Treatment - Highly Significant**
Replication - Not Significant (ns)

## 4. Conclusion

Based on the results, complete fertilizer (NPK) at the rate of 45kgs/ha produced the highest yield and better growth compared to 35kgs/ha and 25kgs/ha. It was observed that NPK enhances the growth and increases the

yield of sweet potato. Proper care and management should also be strictly observed to prevent intervening variables from adversely affecting the growth and yield of sweet potato.

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The authors declare that they have not known competing financial or personal relationship that could have appeared to influence the work reported in this paper.

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