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Effect of Potassium Fertilizer Rate on Growth, Fruit Yield and Nutritional Quality of Tomato Varieties (Lycopersicon Lycopersicum) in Ogbomoso, Oyo State, Nigeria.

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ABSTRACT

This study evaluated the effects of varying potassium (K) fertilizer rates on the growth, fruit yield, and nutritional quality of three tomato varieties in Ogbomoso, Oyo State, Nigeria. The experiment was conducted at Ladoke Akintola University of Technology (LAUTECH), using a 3 × 5 factorial arrangement in a Randomized Complete Block Design (RCBD) with three replications. The tomato varieties tested were Ogbomoso Local, UC82B, and Ilorin Local, while the potassium fertilizer (Muriate of Potash - MOP) was applied at five different rates. Data were collected on plant height, number of leaves, number of flowers, fruit count, fruit length, fruit diameter, fruit weight, and nutritional composition. Analysis of Variance (ANOVA) was performed, and significant differences among means were separated using the Least Significant Difference (LSD) at a 5% probability level. Results revealed that potassium fertilization significantly influenced the growth and yield parameters of the tomato varieties. Among the tested varieties, Ilorin Local showed superior performance in both growth and yield attributes, particularly at the potassium fertilizer rate of 75 kg K_2O/ha. This rate also positively influenced the nutritional quality of the tomato fruits. The study concludes that appropriate potassium fertilization enhances tomato productivity and recommends 75 kg K_2O/ha for optimal performance of Ilorin Local variety in the study area.

Introduction

Lycopersicon lycopersicum, often known as the tomato, is one of the most significant and extensively cultivated vegetables worldwide. Growing in popularity is tomato gardening due to its economic appeal (Naika et al., 2005). Beefsteak tomatoes, plum tomatoes, cherry tomatoes, grape tomatoes, campari tomatoes, tomberries, pear tomatoes, and slicing or globe tomatoes are among the different types of tomatoes that come in different sizes and forms (Fleming, 2013). Products made from a large amount of the world's tomato output include tomato juice, ketchup, puree, paste, canned tomatoes, "sun-dried" tomatoes, and dehydrated pulp. According to Britannica (2019), the fruits are usually consumed raw in salads, pickled, or cooked. By altering disease process pathways, tomatoes' unique nutritional qualities and high mineral and vitamin content help lower the risk of cardiovascular disease and related disorders (Dias, 2012). According to Burton-Freeman and Reimers (2011), they are also a significant source of lycopene, a potent antioxidant with anticarcinogenic properties. After citrus fruits, tomatoes are the second-largest source of vitamin C and a fantastic source of ascorbic acid (Rao and Rao, 2007; Di Matteo et al., 2010). Several vital vitamins and minerals can be found in tomatoes: Vitamin C, an antioxidant and vital nutrient, is present in medium-sized tomatoes in amounts of around 28% of the RDA. Potassium: Helps avoid heart disease and regulate blood pressure. Fekete and associates (2012)

Fertilizer is any material—natural or synthetic—that is sprayed on soil or plant tissues to supply nutrients. Fertilizers are not the same as liming materials or other non-nutrient soil additives. There are numerous synthetic and natural sources of fertilizer. Modern agricultural operations primarily focus on three macronutrients: nitrogen (N), phosphorus (P), and potassium (K). Additionally significant are secondary elements like calcium, magnesium, and sulfur (Britannica, 2024). Calcium phosphate, which is made from phosphate rock or bones, is one type of phosphorus fertilizer. Calcium phosphate can be treated with sulfuric and phosphoric acids, respectively, to provide more soluble forms such as superphosphate and triple superphosphate. Nearly 95%

of commercially manufactured potassium compounds are used in agriculture, and potassium fertilizers like potassium chloride and potassium sulfate are derived from potash sources. More than one of the three main nutrients—potassium, phosphorus, and nitrogen—was present in mixed fertilizers (Britannica, 2024)

Fertilizers based on potassium encourage strong root growth and act as a buffer for plants lacking in other minerals. They prevent the spread of disease and encourage good photosynthesis. According to Almeida et al. (2015), potassium is the nutrient that tomato plants require the most and is found in the highest amounts in plant tissues and fruits. Potassium is taken by plants in its ionic form (K^+) and stays there since it is very mobile and does not contribute to the construction of proteins (Marschner, 2012).

When it comes to loading photosynthetic assimilates into the phloem and moving them from source to sink organs, potassium is essential. Higher yields are the result of a greater accumulation of photosynthetic products, and tomato fruits serve as the main sink organs. Additionally, potassium promotes early fruit maturation and flower development, which raises fruit output (Varis and George, 1985). Tomato fruits become sweeter due to the transportation of sugars, which raises the total soluble solids (TSS) content (Tavallali et al., 2017; Amjad et al., 2014; Javaria et al., 2012).

The cytosol's potassium concentration aids in preserving the ideal pH range for enzyme activation (Marschner, 2012). Enzyme activities that raise reducing and non-reducing sugars and lower starch content cause tomato fruits to mature (Singh et al., 2000). Furthermore, potassium regulates the cation-anion ratio and enhances the acidic flavor by catalyzing the formation of organic acid (Etienne et al., 2013). A potassium deficit lowers the quality of the fruit by causing necrotic areas on the leaf margins and problems with fruit color and shape. This results from inconsistent fruit pigmentation and inadequate photosynthesis brought on by a lack of chlorophyll (Ozores-Hampton et al., 2012; Zhang et al., 2015). Additionally, potassium changes stomatal conductance, which reduces evapotranspiration and increases water usage efficiency (Kanai et al., 2011). Additionally, biotic and abiotic stresses like drought and cold are lessened by potassium (Cakmak, 2005; Wang et al., 2013).

Justification

- One of the elements influencing agricultural crop productivity is increased soil fertility, which can be achieved by using inorganic fertilizers like potassium. The use of inorganic fertilizers increases tomato output and quality by encouraging both vegetative and reproductive growth.

General Objective:

to ascertain how the rate of potassium fertilizer affects Ogbomoso tomato varieties' performance.

Specific Objectives:

- To calculate the right rate of potassium fertilizer needed for tomatoes to grow and yield at their best.
- To recommend the best tomato variety suitable for cultivation in the Ogbomoso agroecological zone.
- To recommend a suitable combination of potassium rate and tomato variety for optimum performance.

Literature Review

History of Tomato

Chile, Peru, and Ecuador are the western South American countries where the tomato (Lycopersicon lycopersicum) first appeared. The Galapagos Islands, the Andes, and the western coast of South America are still home to wild tomatoes. Genetic research of primitive cultivars has revealed that Mexico is the hub of cultivated tomato diversity, despite Peru being the core of wild tomato diversity (Rick 1991b). This suggests that Central America may have been the site of tomato domestication (Rick 1991b). Tomatoes were commonly produced in the Americas when European conquistadors first arrived. In the 16th century, Europeans most likely brought the tomato from the Americas to Europe and its colonies. Interestingly, European immigrants, not Mexicans, brought tomatoes to the United States. One of the most important vegetable crop plants in the world today is the tomato. Today, the globe produces around 120 million tons of tomatoes a year. Carolus Linnaeus placed the tomato in the genus Solanum in 1753 and called it Solanum lycopersicum L. (lycome means "wolf," and persicum means "peach"). To make room for the tomato and a few other species, Philip Miller separated the new genus Lycopersicon from Solanum in 1754. As "esculentum" means "edible," he gave this tomato the name Lycopersicon esculentum Mill after it. Miller might have intended to stress that tomato fruit was edible because many people at the time believed it to be harmful.

The International Code of Botanical Nomenclature (ICBN) states that Lycopersicon lycopersicum ought to have been used in place of Lycopersicon esculentum. However, until recently, Lycopersicon esculentum was commonly used. Potatoes, peppers, eggplants, and tomatoes are all members of the Solanaceae family of nightshades. Although Lycopersicon esculentum is grown as an annual in northern latitudes, it is a perennial in tropical places. According to botany, this vegetable is actually a fruit, specifically a berry. Although small fruited cultivars may have 30 to 50 flowers per cluster, flowers are typically borne in clusters of 4 to 8. The wind is mostly responsible for pollinating the blooms. There are two to eighteen locules (chambers or portions) in the fruit. The tomato originated in the Andes Mountain region of Bolivia, Peru, and Ecuador. It was cultivated when Europeans first came to America, however its exact history is unknown. It wasn't until 1835 that tomatoes were considered a good food crop in the northeastern United States (Nuez 2001).

Ecology

High temperatures are ideal for tomatoes. With a minimum temperature of 10 degrees and a maximum temperature of 35 degrees Celsius, the optimal temperature range for seed germination is 17 to 20 degrees. The majority of field transplants ought to begin once the danger of frost has passed. At 22 C, the growth rate peaks, and at 30 C and lower than 12 C, it begins to drop. Fruit cannot set if the temperature is lower than 16°C or greater than 30°C. When growth temperatures fall below 16 degrees Celsius, cat-faced fruit is produced. Below 16 C, root development does not occur. Particularly during blooming and fruit set, tomatoes need an adequate amount of uniform moisture. Nuez (2001). Soils that are high in organic matter and have enough drainage are ideal for tomato growth. While sandy soils are best for early production, loam and clay loam soils are best for later output. Wind protection is crucial, particularly during the first phases of production. Plastics like row coverings, tunnel homes, and ground mulch are also beneficial for this crop. Field tomato harvesting starts around August 1st, but tunnel house tomato harvesting starts in mid-July. Up until the end of October, production goes on as long as it is financially feasible.

The weather has a big impact on the marketable yields of ripe tomatoes. 10,000–30,000 kg per acre is the range. Though there are biennial and perennial types, tomatoes are often produced as an annual crop despite being a perpetual herbaceous crop. In both tropical and temperate regions, tomatoes are cultivated in open fields or, in the former instance, greenhouses. Large-scale production frequently takes place in greenhouses. It takes about 45 days from germination to anthesis and 90–100 days to achieve the commencement of fruit ripening in a warm climate with adequate light for growth (Nuez, 2001). Whether the crop is meant for the fresh market or the processed market will determine which cultivars are planted, when to harvest them, and whether to use mechanized or human harvesting techniques (Nuez, 2001).

Botany

The tomato plant can grow up to three meters (m) tall and has an indeterminate to determinate growth habit. The main root may reach a maximum length of a few meters. The angular stem's glandular and hairy trichomes give it its distinct aroma. The leaves have a phyllotaxy of 137.5° and are placed alternately on the stem. Leaf segments are grouped pinnately and range in shape from lobed to complex. Five to nine leaflets usually make up a complex leaf. The booklets have dents and petiolations. Each leaf is covered with glandular, hairy trichomes. Tomatoes have globular or oval fruit. Botanically, the fruit has all the characteristics of a berry: it is a simple, meaty fruit with a pulp that holds its seed. The placenta and the remainder of the fruit wall are composed of the thin, fleshy outer skin. The cells that make up the fleshy tissue give the fruit its color. The two types of tomato fruits are bilocular and multilocular. The 50–200 seeds inside the locular chambers are surrounded by gelatinous membranes. The lentil-like seeds are roughly 5 x 4 x 2 mm in size. The embryo and endosperm are found in the seed, which is protected by a robust seed coat known as the testa. After fertilization, the fruit takes seven to nine weeks to develop.

Classification

The "OECD consensus document on compositional considerations for new varieties of tomato" (OECD, 2008) details the composition of toxicants, allergens, anti-nutrients, and vital nutrients for food and feed in addition to the many uses of tomatoes. There has been much discussion on how to classify tomatoes, and because of the genus' diversity, previous taxonomic classifications have been reexamined. Although Lycopersicon lycopersicum (L.) Karsten has also been used, Linnaeus named the tomato Solanum lycopersicum in 1753 (Valdes and Gray, 1998). Miller used Lycopersicon esculentum in The Gardener's Dictionary in 1768. The genus Lycopersicon has nine species, according to Rick (1979). Tomatoes, formerly known as L. esculentum, are now commonly referred to as Solanum lycopersicum after recent research revealed that they actually belong to the genus Solanum (Spooner, Anderson and Jansen, 1993; Bohs and Olmstead, 1997; Olmstead and Palmer, 1997; Knapp, 2002; Spooner et al., 2005, 2003; Peralta et al., 2008). There are over 1,500 species in the genus Solanum. Native to western South America, the domesticated tomato (Solanum lycopersicum) and its twelve wild cousins are members of the tomato clade (section Lycopersicon, originally known as the genus Lycopersicon). Solanum pimpinellifolium and Solanum cerasiforme are the two wild parent species from which the tomato (Solanum lycopersicum) is descended.

It is possible to breed other wild species for desirable quality features, disease resistance, and enhanced color (Ranc et al., 2008). According to Bedinger [2011] and the section on hybridization and introgression, the 12 wild members of the Lycopersicum clade exhibit a significant degree of genetic and phenotypic variety, including a wide range of mating systems and reproductive biology. Peralta, Spooner, and Knapp (2008) reported that there are twelve species of wild tomatoes, up from nine by Rick, Laterrot, and Philouze (1990). Informal species classifications were formed among these 12 species: S. arcanum, S. huaylasense, S. peruvianum, and S. corneliomulleri are four closely related green-fruited species that were lumped together under the general title "S. peruvianum sensu lato."

Two species native to the Galapagos Islands, S. galapagense and S. cheesmaniae, are part of another group of species having yellow to orange fruits. The introduction of tomatoes to the Old World after European contact can be reconstructed using historical sources. Friars transferred some of the seeds that Spanish navigators brought to Europe in the sixteenth century to their brethren. The tomato spread throughout Spain after initially arriving in Andalusia (via the Canary Islands). The Spanish and Italians were the first to adopt this "exotic" fruit.

According to Mattioli, it was eaten in Italy with salt, pepper, and oil (Nuez et al., 1996; Rick, 1978). The tomato was not commonly embraced in other European nations due to the fear of poisoning or "the curse of the dulcamara," and it was instead preserved as a decorative plant (Long Towell, 2001). This notion was linked to the poisonous, hallucinatory, and aphrodisiac properties of other members of the Solanaceae family, such as Belladona (Belladona) and Mandragora (Mandragora), which had negative health consequences due to certain alkaloids (OECD, 2008). The first person in England to mention tomatoes was the botanist Gerard in 1597. German naturalist Besler displayed tomato plant engravings at the Eichstätt Garden in Germany in 1613. The size of the fruit suggests that the engravings depict ornamental plants that have already been domesticated. The French catalog Andrieux-Vilmorin identified tomatoes as ornamentals in 1760 (Fournier, 1948).

Distribution

the 18th century, European immigrants brought tomatoes to North America by arriving in commercial harbors in New Jersey, USA. The first written mention of it dates back to 1710, when William Salmon registered it as an attractive plant. However, because it resembled some deadly fruits, it wasn't considered a safe meal in the United States until the early 1900s (Rick, 1978). Between the conclusion of the 19th century and the start of the 20th century, more individuals learned about the nutritional benefits of tomatoes (Rick, 1978). The small, hard, and wrinkled tomato was transformed into the red, smooth, and juicy types currently in use by Italian breeders in the 17th and early 18th centuries (Atherton and Rudich, 1986; Rick, 1976). The Favorite Early Smooth of the Cook Starting with these cultivars, nine commercial varieties, including Tildem, Powells Early, FEUE, Large Red, Large Yellow, Tree Tomato Red, and Yellow Plum, were produced in the United States in 1867 (Atherton and Rudich, 1986). Despite its tropical beginnings, the tomato is a worldwide crop that is primarily farmed in temperate climates.

Classification of Tomato

The tomato is a nightshade that is a member of the Solanaceae family and genus Solanum.

Kingdom: Plantae - Plants

Subkingdom: Tracheobionta - Vascular plants

Superdivision: Spermatophyta - Seed plants

Division: Magnoliophyta - Flowering plants

Class: Magnoliopsida - Dicotyledons

Subclass: Asteridae

Order:: Solanales

Family: Solanaceae Juss. - Potato family

Genus: Solanum L. - nightshadeP

Species: Solanum lycopersicum L. - garden tomatoP

Uses Of Tomato

- **Associated with a Lower Risk of Cancer**

  Numerous studies have found that men who eat a lot of tomatoes, especially cooked ones, had a lower risk of prostate cancer. 3. Beta-carotene and lycopene, two antioxidants found in tomatoes, may have anticancer properties. Antioxidants protect cells from the kind of DNA damage that can lead to the development of cancer and eradicate cancerous cells.

- **Enhance Heart Health**

A diet rich in tomatoes may help avoid heart disease, the leading cause of mortality for people in the United States. One research found that high blood levels of the antioxidant and a high lycopene intake reduced the risk of heart disease by 14%. Another study examined the effects of consuming tomatoes, tomato sauce, and gazpacho, a chilled tomato soup, on blood pressure in older persons. High blood pressure, or hypertension, is one risk factor for heart disease. The researchers discovered that eating more tomatoes reduced the risk of high blood pressure by 36%.

- **It might help avoid constipation.**

Constipation may result from inadequate fiber intake. Constipation may be resolved by eating tomatoes, which are rich in insoluble and insoluble fiber. While insoluble fiber adds bulk to the stool during digestion, soluble fiber retains water to create a gel-like consistency. The garbage produced by both of those changes is easily disposed of. 8. The large intestine finds it difficult to break down tomato fibers, particularly cellulose, hemicelluloses, and pectin, which help the stool form properly.

- **Reduce the Risk of Type 2 Diabetes**

In the United States, diabetes affects about 15% of adults. Prediabetes, or higher-than-normal blood sugar, affects an additional 38% of individuals. According to some study, lycopene may help prevent type 2 diabetes by reducing inflammation and minimizing cell damage.

- **Support Brain Health**

Alzheimer's disease (AD), a kind of dementia that affects thinking, memory, and behavior, affects more than six million persons 65 and older in the US. Twelve There is no known cure for the illness, which worsens over time. According to some research, tomatoes' lycopene and other antioxidants may provide protection against AD. It has been demonstrated that those 70 years of age and older who consume more lycopene than others see a slower loss in cognitive function. Further human studies are required to further understand the potential preventive advantages of tomatoes and AD, particularly in persons aged 60–65.

NUTRITIONAL VALUE OF TOMATO

22.5 kcal 0.25 grams of fat (g) A total of 6.25 mg of sodium 4.86 grams of carbs 1.5 grams of fiber Added sugars: 0g 1.1 grams of protein Tomatoes also include several macronutrients, including: Together with vitamins B12 and C, folate aids in DNA synthesis, the production of red blood cells to prevent anemia, and the breakdown, usage, and generation of new proteins and tissues. Potassium: Helps in protein synthesis, glucose breakdown and use, cardiac rhythm modulation, and pH equilibrium. Vitamin C: Promotes healing, aids in the absorption of iron, and has antioxidant properties. Vitamin K: Supports healthy bones and blood coagulation.

Cultivation and Cultural Practice

Climate

Temperature and Light.

The optimal daily mean temperature range for tomato development, yield, and fruit quality is 20°C to 24°C. Poor fruit set results from flowers being shed at temperatures below 12°C or above 35°C; the quality of the fruits produced in these situations may also suffer. Even in frost-free areas, it is not recommended to try tomato production in the winter, when mean temperatures frequently fall below the crucial margin of 12°C. The optimal soil temperature for tomato seed germination is between 15°C and 30°C.

Water and Humidity

A simple rule of thumb can be used to determine whether local water supplies are adequate for tomato growth. If there are herbaceous plants (plants with many thin leaves) in the area, tomatoes can be grown there. There will likely be rain for at least three months. Water stress and extended dry spells will divide the fruit and cause the buds and blooms to fall off. However, excessive rain and high humidity will cause mold to grow and the fruit to decay. Cloudy sky will slow down the ripening of tomatoes. However, certain cultivars have been modified. For hot, humid conditions, seed firms offer special tomato cultivars.

Soil Requirement of Tomato

Tomatoes may be grown in the majority of mineral soils that have adequate aeration, water-holding capacity, and no salt. It prefers sandy loam soil that is deep and well-drained. The topmost layer ought to be allowed to pass through. A good crop requires a soil depth of 15 to 20 cm. Deep plowing enhances root penetration in hard clay soil. Although plants can tolerate mild acidity across a wide pH range, tomatoes prefer soil with a pH of 5.5 to 6.8 and sufficient nutrient availability and supply. Adding organic matter generally encourages robust growth. Because of their high water-holding capacity and nutritional deficits, soils with a high organic matter content—such as peat soils—are less appropriate.

Limitations Of Tomato Production

Perishable produce, a poorly organized market, inadequate storage facilities, high agrochemical costs, poor credit facilities, high transportation costs, poor roads, high labor costs, high interest rates on credit, insufficient water for dry season production, availability of tomatoes during and after the season, grazing activities, high land costs, high rates of pests and diseases (such as anthracnose fruit rot, early blight, flea beetles, aphids, leafminers, stink bugs, and tomato fruitworms), perishable produce, and poorly organized markets were among the main barriers to tomato production.

Fertilizer Requirement of Tomato

Tomatoes require frequent fertilizer applications due to their high fertilizer needs. A high production of tomatoes depends on applying the right fertilizer mixture at the right time and rate. When proposing fertilizer for tomatoes grown in soil, consideration should be given to the yield target, growth stages, and field, including soil test results, water quality, and tissue analysis. The optimum fertilizer for tomato plants includes macronutrients like potassium, phosphorus, and nitrogen along with vital micronutrients like calcium, boron, zinc, and magnesium. However, the ratio of essential minerals needed by tomatoes varies depending on the growth cycle (Brandon Lobo, 2020). Nitrogen helps with foliage, potassium helps with flowering and general growth, and phosphorus is necessary for root development.

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In tomato fruits, symptoms including "blotchy ripening," "waxy patch," "uneven pig-mentation," "vascular browning," "white wall," "gray wall," and "coud" diminished as the rate of K fertilization increased, but their flavor improved 11. Stomatal movement, which regulates the plant's water content, depends on potassium. It facilitates the activation of enzymes and is essential for nitrogen metabolism, protein synthesis and metabolism, the translocation and metabolism of carbohydrates, and the control of cell sap concentration. Ismail, E.A.M., Abou-Hadid, A.F., El-Beltagy, A.S., and Abdel-Samad, S. (1996)

Nitrogen: helps maintain the leaves, but too much of it can result in bushy plants that bear little to no fruit.

Phosphorus is essential for both fruit and root growth and development. For this reason, it is a crucial nutrient both in the early and late stages. Phosphorus aids in the early establishment of the plant right after transplanting or seeding because it helps to start the growth of tomato roots. Tomato plants typically receive a starter solution with a high P concentration a few days after transplanting in order to promote early root establishment and development in the soil. In addition to encouraging a robust growth of stem and healthy foliage, P's stimulation of vigorous root growth aids in the soil's improved use of water and other nutrients.

Phosphorus is one of the components of nucleic acids. Because it produces a lot of flowers, it helps tomatoes mature early and seeds and fruits set early. This leads to increased production of tomato fruits with higher acidity and total soluble solids levels. It also improves the color of the skin and pulp, flavor, toughness, and vitamin C content. (Winsor, G.W., Davis, J.N., & Long, M.I.E. 1967.)

Required macronutrients and micronutrients for tomato

Nitrogen	For continuous growth of foliage
Phosphorus	Helps to initiate root growth of tomato and therefore aid in early establishment of the plant immediately after transplanting or seedlings.
Potassium	Potassium helps in vigorous growth of tomato and stimulates in early flowering and setting of fruits, thereby increasing the number and production of tomatoes per plant 39 . Potassium nutrition can affect the quality of tomato fruit. Winsor
Calcium	For root and leaf growth. For ongoing foliage growth aids in the early establishment of the plant right after transplanting or seedlings by promoting the growth of the tomato's roots. NPotassium promotes early flowering and fruit setting and aids in the tomato's vigorous growth, which increases the quantity and yield of tomatoes per plant 39. Tomato fruit quality can be impacted by potassium nutrition. Winsor to promote the growth of roots and leaves and aid in the production of firm tomatoes. Enhance fruit quality, flowering, and plant health. fruit ripening and even flowering. and to help produce firm tomatoes.
Magnesium	Help keep the plant green, improve flowering and fruit quality.
Boron and Zinc	Flowering and even ripening of the fruit.

(degarden.com - Brandon Lobo,2020)

Effect of potassium on fruit vegetables

Potassium is an essential plant mineral element (nutrient) that has a major impact on several quality compounds in fruits and vegetables that are related to human health (Usherwood, 1985). K is engaged in several physiological and biochemical processes that are essential to plant growth, yield, quality, and stress, despite not being a component of any organic molecule or plant structure (Marschner, 1995; Cakmak, 2005). In addition to regulating stomata for transpiration and photosynthesis, K is involved in photophosphorylation, phloem-mediated transfer of photoassimilates from source tissues to sink tissues, enzyme activation, turgor maintenance, and stress management (Usherwood, 1985; Doman and Geiger, 1979; Marschner, 1995; Pettigrew, 2008).

Adequate K nutrition has also been associated with better fruit color, longer shelf life, larger fruits, higher yields, higher concentrations of vitamin C and soluble solids, and better shipping quality for several horticultural crops (Geraldson, 1985; Lester et al., 2005, 2006, 2007; Kanai et al., 2007).

Tomato varieties

Cherry Tomato:- Small and round, often sweet. Popular varieties-Sweet 100, Sun Gold, Black Cherry

2. Grape Tomatoes: -Small, oval-shaped, and thicker skin compared to cherry tomatoes.

- Examples: Juliet, Red Pearl, Sugary.

3. Roma (Plum) Tomatoes:- Oblong shape, meaty with fewer seeds, Best for sauces and pastes.Examples: San Marzano, Amish Paste

4. Beefsteak Tomatoes: Large, round, and juicy, Ideal for slicing and sandwiches.

Varieties: Big Boy, Brandywine, Cherokee Purple.

5. Campari Tomatoes: Medium-sized, sweet, and juicy, Good balance of sugar and acidity.

Diseases of Tomato

Septorial leaf spot

Small, circular splotches on the leaves are the typical first signs of this tomato disease (Septoria lycopersic). Usually, each leaf has a lot of dots, each with dark brown rims and a lighter center. The diseased ring eventually becomes brown, yellow, and eventually falls off. **Prevention:** At the end of the growing season, remove any unhealthy tomato plants to prevent the spores from hibernating in the garden. Cut off and destroy any contaminated leaves as soon as you see them. Make sure the pruning tools are clean before beginning a new plant. **Management**: Organic fungicides based on copper or Bacillus subtilis work well against Septoria leaf spot when applied as a prophylactic.

Southern bacterial wilt

Unfortunately, Southern bacterial wilt (Ralstonia solancearum) spreads like wildfire once it infects tomato plants. The bacteria that cause this tomato disease is soil-borne, but it can also spread through water, plant waste, soil, and even human skin, clothing, and utensils. It can enter the garden through diseased plants bought from other sources, even though it is naturally abundant in tropical areas and greenhouses. When only a tiny percentage of a plant's leaves wilts, the foliage looks to be in fine health. Over time, as more and more of the leaves wilt and become yellow, the stem stays upright while all of the leaves eventually die. When the chopped stems are submerged in water, a milky stream of bacteria emerges from the slimy oozing thread. Over time, as more and more of the leaves wilt and become yellow, the stem stays upright while all of the leaves eventually die. A milky stream of bacteria and sticky slime thread emerge from the sliced stems when they are submerged in water.

Prevention: Soil-borne southern bacterial wilt can linger on plant and root debris for a long time. Like many other tomato diseases, it favors high humidity and temperatures. The best way to prevent this disease is to start from seed or purchase and plant only locally grown plants. Southern bacterial wilt is more common in warmer climates, though it has been found in Massachusetts and other northern areas.

Management: It's difficult to manage, and no single strategy has so far shown itself to be 100% successful. In the field, R. solanacearum has not been suppressed by bactericides (copper) or antibiotics (streptomycin, ampicillin, tetracycline, and penicillin). Using them is also expensive and bad for the environment. An integrated pest management approach should use a range of control methods, including chemical or biological control, host resistance, and cultural practices, to prevent tomato bacterial wilt in regions where the disease is established.

Fusarium wilt

Fusarium oxysporum, the pathogen that causes fusarium wilt, is typically more prevalent in warm, southern regions and can completely destroy an entire field of tomato plants. A drooping leaf stem is one of the indicators. Occasionally, a whole branch will wilt; this normally begins at the base of the plant and moves upward until the entire plant topples. Cut up the plant's main stem and check for a dark streak running lengthwise across it to verify an infection. Dark cankers can occasionally be seen at the plant's base as well.

Prevention: For many years, the spores of this tomato plant disease can persist in the soil. Plant debris, water, equipment, and even people and animals can spread them. Planting resistant varieties is the best way to prevent Fusarium wilt if there has previously been an issue. Additionally, at the end of each season, tomato cages and stakes should be cleaned with a 10⁰/⁰ bleach solution.

Management: The key is crop rotation, and fungus spores in the top few inches of soil can be eliminated via soil solarization. Other biological fungicide drenches that can be sprayed on soil include Soil Guard, a granular fungicide based on the fungus Trichoderma viren, and MycoStop, a bacterium based on Streptomyce griseoviridis. Future crop roots may be shielded against the infection by these products.

Early blight

This widespread tomato plant disease manifests as brown dots on the bottom leaves that resemble bull's-eyes. The tissue surrounding the spots will frequently turn yellow. The infected leaves will gradually fall off the plant. Usually, the tomatoes will still ripen as the disease's symptoms spread up the plant.

Prevention: Once a garden shows signs of the early blight fungus, it will stay there because Alternaria solani, the early blight pathogen, can readily overwinter in soil, even in very cold locations. Fortunately, most tomatoes will continue to produce even in incidences of early blight that are somewhat severe. This mulch prevents soil-dwelling spores from splashing up onto the plant from the soil by forming a barrier.

Management: Organic fungicides based on copper or Bacillus subtilis can help prevent or delay the spread of tomato plant disease once the fungus has established itself. Two effective bicarbonate fungicides are GreenCure and BiCarb.

MATERIALS AND METHODS

Experimental Site

Ladoke Akintola University of Technology (LAUTECH), located in Ogbomoso, Oyo State, Nigeria, was the site of the field experiment. Ogbomoso is located in Nigeria's Southern Guinea Savanna agro-ecological zone, at latitude 8°10'N and longitude 4°10'E. Both the South-West Trade Wind (April to October), which brings warm and humid conditions, and the North-East Trade Wind (November to March), which brings dry conditions, have an impact on the climate. Except for January, when dry winds predominate, the humidity in the area is constantly high, reaching up to 74%. Over 1000 mm of rain falls there each year, with June and September seeing the highest amounts and August seeing a brief decrease. According to Olaniyi (2006), the dry season lasts from November to February, and the rainy season lasts from March to October).

Materials Used

Materials utilized in this study included tomato seeds sourced from Irorun Agbe farmer shopping center, Ogbomoso, Other materials included inorganic fertilizers (obtained from LAUTECH Teaching and Research Farm), watering cans, hoes, cutlasses, buckets, insecticides, pesticides, and a weighing balance.

Treatments and Experimental Design

The experiment was arranged in a factorial and fitted into a Randomized Complete Block Design (RCBD). Each experimental bed measured 1 m × 1 m, with 15 treatments arranged in three replicates, totaling 45 beds. Each bed accommodated nine plants.

V1T0	V1T0	V1T0
V1T50	V1T50	V1T50
V1T75	V1T75	V1T75
V1T100	V1T100	V1T100
V1T125	V1T125	V1T125
V2T0	V2T0	V2T0
V2T50	V2T50	V2T50
V2T75	V2175	V2T75
V2T100	V2T100	V2T100
V2T125	V1T125	V2T125
V3TO	V3TO	V3TO
V3T50	V3T50	V3T50
V3T75	V3T75	V3T75
V3T100	V3T100	V3T100
V3T125	V3T125	V3T125

The 3 × 5 factorial experiment was laid out in randomized complete blocks design, with three replicates.

Nursery Operations

Tomato seedlings were initially raised in a nursery. The land was manually cleared, and debris was removed before preparing three nursery beds. Seeds were sown and watered regularly, while palm fronds were used as mulch to shield the seeds and seedlings from direct sunlight and predators such as birds. After seven weeks, seedlings were transplanted into the permanent field. Transplanting was followed by regular watering until rainfall became sufficient. Variety and fertilizer rates are;

Tomato varieties: UC82B, Ogbomoso Local, and Ilorin local.

Fertilizer rates: 0 kg, 50 kg, 75 kg, 100 kg, and 125 kgK_2O/ha

The 3 × 5 factorial experiment was laid out in randomized complete blocks design, with three replicates

Land Preparation and Layout

The experimental land was manually cleared using hoes and cutlasses. Beds measuring 1 m × 1 m were prepared, resulting in 15 treatment combinations arranged in three replicates, with 45 beds in total. Each bed accommodated nine tomato plants.

Cultural Practices

Field preparation was performed manually using hoes and cutlasses. Transplanted seedlings were mulched in the nursery to prevent direct exposure. Regular watering was carried out to promote growth. Weeding was performed biweekly using hoes, cutlasses, and manual hand-picking to reduce competition and disease spread. Fertilizers were applied, and cypermethrin (5 ml in 1 liter of water) was sprayed to control pests and insects.

Data Collection

Data collection began five weeks after transplanting and continued at two-week intervals. Growth parameters and yield were recorded at full maturity.

- **Number of Leaves**: Counted visually by direct observation of fully opened leaves.

- **Plant Height (cm):** Measured using a measuring tape from the base of the stem to the tip.
- **Number of Branches:** Counted through visual observation.

Harvesting

Harvesting tomato fruit was done every five days starting 14 weeks after planting. Hand-picking was the method used for harvesting. After being collected, the fruits were packed in nylon bags and brought to the lab for additional examination.

Statistical Analysis

The Genstat software package for analysis of variance (ANOVA) was used to statistically analyze the collected data. The Least Significant Difference (LSD) test was used to assess differences in treatment means at a 0.05 probability level.

RESULTS AND DISCUSSION

Growth Parameters

The growth performance of tomato plants was significantly influenced by both the tomato variety and potassium fertilizer application rates.

Effect of Variety on Plant Height

The mean plant heights of the three tomato varieties are presented in Table 1. At 5 WAT, the Ilorin variety recorded the tallest plants (70.36 cm), followed by the Ogbomoso variety (65.18 cm), while the Hausa variety exhibited the shortest plants (59.94 cm). At 7 WAT, Ogbomoso local variety had the tallest plants (45.80 cm), followed by the Ilorin variety (43.73 cm), and the Hausa variety remained the shortest (40.46 cm). The differences were statistically significant ($p < 0.05$), indicating variations in growth potential among the varieties.

Effect of Fertilizer Rate on Plant Height

Potassium fertilizer rate significantly affected plant height at all sampling periods shown in Table1. At 5 WAT, plants treated with 75 kg K_2O ha potassium fertilizer recorded the tallest height (72.98 cm), while plants with no fertilizer (0 kg/ha) had the shortest (50.65 cm).At 7 WAT, the tallest plants (53.24 cm) were observed in the 100 kg K_2O ha treated plants, while plants treated with no fertilizer (36.15 cm) or 50 kg K_2O ha kg K_2O ha (39.37 cm) showed the shortest heights.

The findings suggest that an optimal potassium fertilizer application rate exists, beyond which plant height may plateau or decline.

Interaction Effect of Variety and Fertilizer Rate on Plant Height

The interaction effects of variety and fertilizer application rates are shown in Table 2.At 5 WAT, Ogbomoso local treated with 100 kg/ha fertilizer had the tallest plants (79.39 cm), followed by Ilorin local at the same fertilizer rate (75.17 cm). The shortest plants (38.39 cm) were recorded in Ogbomoso local with no fertilizer application.At 7 WAT, Ogbomoso local treated with 75 kg/ha fertilizer recorded the tallest plants (52.22 cm), followed by Ilorin treated with 100 kg/ha (50.33 cm). Consistently, the lowest heights were observed in plants that received no fertilizer across all varieties.These results highlight the importance of the interaction between variety and fertilizer rate in determining the optimal growth of tomato plants.

Table 1. Effect of varieties and fertilizer rate of plant of tomato at different sampling period

Plant height		
variety	5	7
Ogbomoso	65.18	45.80
Hausa	59.94	40.46
Ilorin	70.36	43.73
LSD(0.05)	13.38	7.88
K rate(kg/ha)		
0	50.65	36.15
50	66.91	39.37
75	72.98	45.52
100	70.56	53.24
125	64.70	47.37

LSD(0.05)	17.27	10.17

Table 2. The interaction effect of varieties and fertilizer rate of plant height

		Plant height (cm)	
Week after transplanting		5	7
Variety	K rate (kg/ha)		
OGBOMOSO	0	38.39	35.94
	50	66.11	45.83
	75	73.56	52.22
	100	79.39	50.33
	125	64.44	44.46
	0	55.00	33.66
	50	65.83	37.61
	75	65.56	42.06
	100	57.11	42.94
Hausa	125	56.22	46.01
	0	58.56	38.83
	50	68.78	34.67
	75	79.83	42.28
	100	75.17	66.44
Ilorin	125	68.44	51.45
LSD		29.92	17.62

Effect of Varieties on Number of Leaves

The number of leaves of tomato plants as influenced by variety is shown in Table 3.At 5 WAT, the Ilorin variety recorded the highest number of leaves (76.65), while the Hausa variety exhibited the lowest (65.29).At 7 WAT, Ogbomoso local variety had the highest number of leaves (45.22), while Hausa again had the lowest (31.42).

Varietal differences significantly influenced the number of leaves ($p < 0.05$).

Effect of Potassium Fertilizer Rate on Number of Leaves

Potassium fertilizer application significantly influenced the number of leaves at all sampling periods:At 5 WAT, the highest number of leaves (88.74) was observed in tomato plants treated with 100 kg/ha of fertilizer, while the control (0 kg/ha) recorded the lowest (41.80).At 7 WAT, plants treated with 75 kg/ha fertilizer recorded the highest number of leaves (44.96), while the 125 kg/ha treatment produced the lowest (28.39).

Interactive Effect of Varieties and Fertilizer Rate on Number of Leaves

The interaction effects of variety and fertilizer application rate are presented in Table 4:At 5 WAT, Ogbomoso local with 75kg K_2O/ha fertilizer recorded the highest number of leaves (106.78), while the control had the lowest (49.56).At 7 WAT, the highest number of leaves (63.00) was observed in Ogbomoso local treated with 75kg K_2O ha fertilizer, and the lowest (27.33) in the 125kg K_2O ha treatment.UC82B variety treated with 100 kg K_2O ha fertilizer showed significant improvement at 5 WAT (69.55), but the lowest number of leaves at 7 WAT was observed in the 125kg K_2O ha treatment

(19.00).The Ilorin local variety treated with 100 kg K_2O ha fertilizer had the highest number of leaves at 5 WAT (106.11) and at 7 WAT (55.94).This data underscores the importance of tailoring fertilizer application rates to specific tomato varieties to maximize leaf development.

Table 3. EFFECT OF VARIETIES AND FERTILIZER RATE ON NUMBER OF LEAVES

Variety	**No of leaves**	
Week after transplanting	5	7
OGBOMOSO	73.04	45.22
Hausa	65.29	31.42
Ilorin	76.65	38.07
LSD(0.05)	29.64	15.71
k rate (kg/ ha)		
0	41.80	34.11
50	64.81	40.74
75	87.89	44.96
100	88.74	42.98
125	75.07	28.39
LSD(0.05)	38.26	20.28

Table 4. THE INTERACTION OF VARIETIES AND FERTILIZER RATE ON NUMBER OF LEAVES

	No. of leaves		
	Week after transplanting		
Variety	K rate (kg/ha)	5	7
	0	26.17	47.22
	50	67.05	51.89
	75	106.78	63.00
	100	90.56	36.67
OGBOMOSO	125	74.67	27.33
	0	49.56	27.33
	50	62.11	37.89
	75	68.56	36.00
	100	69.55	36.33
Hausa	125	76.67	19.56
	0	49.67	27.78
	50	65.28	32.44
	75	88.33	35.89

	100	106.11	55.94
Ilorin	125	73.89	38.28
LSD		66.27	35.12

Effect of Varieties on Fruit Yield and Yield Components of Tomato Plants

The effect of tomato varieties on fruit yield and yield components is shown in Table 5:**Number of Flowers**: Ogbomoso local variety recorded the highest number of flowers (33.93), while Hausa had the lowest (22.78).**Number of Fruits**: Ilorin variety recorded the highest number (23.88), and UC82B had the lowest (14.30).**Fruit Length**: Ogbomoso local had the highest fruit length (10.08), and UC82B had the lowest (8.93)**Fruit Diameter**: Ilorin variety recorded the highest fruit diameter (145.75), while UC82B had the lowest (15.73).**Fruit Weight**: Ilorin variety produced the highest fruit weight (450.50 g), while UC82B produced the lowest (255.23 g).Varietal differences significantly influenced fruit yield and yield components ($p < 0.05$).

Effect of Potassium Fertilizer Rate on Fruit Yield and Yield Components

The effect of potassium fertilizer rates on fruit yield and yield components is presented in Table 5:**Number of Flowers**: The 100 kg K_2O ha treatment recorded the highest value (37.84), while the control had the lowest (21.05).**Number of Fruits**: The 75 kg K_2O ha treatment produced the highest number of fruits (27.15), and the control had the lowest (14.30).**Fruit Length**: The 75 kg K_2O ha treatment recorded the highest value (11.03), while the control had the lowest (8.33).**Fruit Diameter**: The 100 kg K_2O ha treatment recorded the highest fruit diameter (237 mm), and the control had the lowest (12.24 mm).**Fruit Weight**: The 75 kg K_2O ha treatment produced the heaviest fruit weight (255.22 g), while the control had the lowest (135.89 g).Fertilizer rates significantly influenced fruit yield and yield components ($p < 0.05$).

Interactive Effect of Varieties and Fertilizer Rate on Fruit Yield and Yield Components

The interaction effects of variety and fertilizer rates are presented in Table 6:**Number of Flowers**: Ogbomoso local with 100 kg K_2O ha fertilizer recorded the highest number of flowers (56.11). UC82 and Ilorin local varieties with 75 kg K_2O ha fertilizer recorded high values (25.45 and 40.55, respectively), while the control had the lowest (18.00, 21.22, and 23.94, respectively).**Number of Fruits**: Ogbomoso local with 75 kg K_2O ha fertilizer recorded the highest number of fruits (27.94). Hausa and Ilorin varieties with 75 kg K_2O fertilizer had values of 22.46 and 31.05, respectively, while the control produced the lowest (12.96, 12.39, and 17.56, respectively).

Fruit Length: Ogbomoso local with 75 kg K_2O ha fertilizer had the highest fruit length (11.65). UC82B and Ilorin varieties with 75 kg/ha fertilizer also showed high values (10.60 and 10.85, respectively). The control had the lowest fruit lengths for UC82B and Ilorin (7.69 and 6.46, respectively).**Fruit Diameter**: Ogbomoso local with 50kg K_2O ha fertilizer recorded the highest fruit diameter (20.37). UC82B and Ilorin local varieties with 100 kg K_2O ha fertilizer recorded values of 21.05 and 67.16, respectively, while the control had the lowest values (14.50, 10.56, and 11.66, respectively).**Fruit Weight**: Ogbomoso local with 125kg K_2O ha fertilizer recorded the highest fruit weight (442.70 g). UC82B with 75 kg K_2O ha fertilizer and Ilorin with 50 kg K_2O ha fertilizer recorded high values (358.40 g and 825.82 g, respectively), while the control produced the lowest values (49.57 g, 164.77 g, and 193.33 g, respectively).The interactive effects of variety and fertilizer rate significantly influenced fruit yield and its components.

Table 5. Effect of variety on fruit yield and yield components

	Yield and component				
Variety	NFl	NF	Fl	FD	FWT
Ogbomoso	33.93	22.68	10.08	18.20	295.46
Hausa	22.78	16.93	8.93	15.73	255.22
Ilorin	31.08	23.48	9.17	145.75	450.50
LSD	6.99	8.61	2.03	218.01	211.87
k rate (kg/ha)					
0	21.05	14.30	8.33	12.24	135.89
50	27.11	20.34	8.84	17.08	434.29
75	34.83	27.15	11.03	17.68	384.32
100	37.84	20.57	9.59	237	327.02
125	25.48	22.79	9.19	14.98	337.12
LSD	9.04	11.11	2.63	281.45	273.52

No Fl : Number of flowers Fl: Fruit length. FWT: Fruit weight

NFr: Number of fruit FD: Fruit diameter

Table 6. The interaction of varieties and fertilizer rate of fruit yield and yield component

Yield and Yield Component

Variety	k rate (kg/ha)	NFl	NFr	Frl	FD	FWT
Ogbomoso	0	18.00	12.96	10.83	14.50	49.57
	50	32.50	24.11	6.97	20.37	252.86
	75	38.50	27.94	11.65	18.69	392.01
	100	56.11	22.11	10.81	19.60	340.17
	125	24.56	26.27	10.16	17.81	442.70
Hausa	0	21.22	12.39	7.69	10.56	164.77
	50	22.78	17.17	9.32	15.85	224.20
	75	25.45	22.46	10.60	17.47	358.40
	100	23.20	14.16	8.02	21.05	196.18
	125	21.28	18.49	9.04	13.73	332.56
Ilorin	0	23.94	17.56	6.46	11.66	193.33
	50	26.06	19.73	10.22	15.00	825.82
	75	40.55	31.05	10.85	16.88	402.55
	100	34.22	25.44	9.93	671.65	444.70
	125	30.61	23.61	8.37	13.40	236.11
LSD		15.65	19.25	4.54	487.49	473.75

No Fl : Number of flowers Fl: Fruit length. FWT: Fruit weight

NFr: Number of fruit FD: Fruit diameter

Effect of Varieties on Proximate Content

The effect of varieties on proximate content is summarized in Table 7: **Crude Protein (CP)**: UC82B variety recorded the highest value (1.28), while Ilorin variety had the lowest (1.17). **Crude Fat (CF)**: UC82B variety had the highest CF value (0.35), while Ilorin variety had the lowest (0.33). **Ash Content**: Ogbomoso local variety recorded the highest value (0.26). U 82B and Ilorin local varieties had the lowest values (0.03). **Carbohydrate Content (CHO)**: Ilorin local variety recorded the highest value (100.98), while UC82B variety had the lowest (100.78). **Moisture Content (MC)**: Ilorin local variety had the highest value (96.91), while UC82B variety recorded the lowest (96.23). The effect of varieties on proximate content was statistically significant.

Effect of Fertilizer Rate on Proximate Content

The influence of fertilizer rates on proximate content is presented in Table 7:**Ash Content**: The 75kg K_2O ha MOP treatment recorded the highest value (0.04), while the other treatments showed similar values.**Crude Fat (CF)**: The 100 K_2O ha MOP treatment recorded the highest CF value (0.35), while the control had the lowest (0.27).**Crude Protein (CP)**: The 125 K_2O ha MOP treatment had the highest CP value (1.28), while the control recorded the lowest (1.19). **Carbohydrate Content (CHO)**: The control treatment recorded the highest CHO value (100.94), while 125 K_2O ha MOP had the lowest (100.71). **Moisture Content (MC)**: The 50 K_2O ha MOP treatment recorded the highest MC value (97.34), while the control had the lowest (97.27).

Fertilizer rates significantly influenced CP, CF, CHO, and MC, but there was no significant effect on ash content.

Interactive Effect of Varieties and Fertilizer Rate on Proximate Content

The interactive effects are presented in Table 8:

Crude Fat (CF): Ogbomoso and Hausa varieties with 100 kg/ha recorded the highest values (0.34 and 0.38). Ilorin variety with 75, 100, and 125 K_2O ha recorded similar values (0.34).

Ash Content: Ogbomoso and Ilorin varieties with 75 K_2O ha and UC82B variety with 125 K_2O ha recorded the highest values (0.04). Other fertilizer rates had no significant influence.

Carbohydrate Content (CHO): UC82B and Ilorin varieties with 75 K_2O ha and 50 K_2O ha had the highest values (100.82 and 100.85), while 100 K_2O ha and 125 K_2O ha treatments had the lowest (100.75 and 100.71). Ogbomoso variety with control had the highest CHO value (101.16), while the 75 K_2O ha and 125 K_2O ha treatments had the lowest (100.88).

Crude Protein (CP): UC82B variety with 100 and 125 K_2O ha recorded the highest values (1.35). Ogbomoso and UC82B varieties with control recorded the lowest values (1.12 and 1.23).**Moisture Content (MC)**: Ogbomoso with 50 K_2O ha recorded the highest value (97.79), while 75 kg/ha MOP had the lowest (95.12). Hausa with control recorded the highest MC (97.77), while Hausa with 125 K_2O ha had the lowest (93.20).

The interactive effect of varieties and fertilizer rates significantly influenced CP, CF, CHO, and MC, but not ash content.

Table 7. Effect of varieties and fertilizer rate on proximate contents

Variety	**CP**	C F	C-Fat	CHO	Ash	MC
Ogbomoso	1.25	0.26	0.04	100.79	0.26	96.80
Hausa	1.28	0.35	0.04	100.78	0.03	96.23
Ilorin	1.17	0.33	0.04	100.98	0.03	96.91
LSD	0	0.00	0	0	0	0.55
k rate (kg/ha)						
0	1.19	0.27	0.04	100.94	0.03	97.27
50	1.21	0.27	0.04	100.91	0.03	97.34
75	1.23	0.33	0.05	1000.82	0.04	95.96
100	1.25	0.35	0.04	100.79	0.03	96.73
125	1.29	0.33	0.04	100.78	0.03	95.95
LSD	0	0	0		0	0.72

CP: Crude protein, CF: Crude fiber, C-fat: Crude fat, ash, MC: Moisture content.

Table 8. The interaction of varieties and fertilizer rate on proximate content

Variety	(kg/ha)	CP	CF	C-Fat	CHO	Ash	MC
Ogbomoso	0	1.12	0.15	0.03	0.03	0.02	96.87
	50	1.15	0.16	0.04	0.04	0.03	97.79
	75	1.19	0.32	0.05	0.05	0.04	95.12
	100	1.17	0.34	0.04	0.04	0.02	96.46
	125	1.25	0.32	0.03	0.03	0.02	97.77
Hausa	0	1.23	0.34	0.05	0.05	0.03	97.77

	50	1.25	0.36	0.04	0.04	0.03	97.07
	75	1.24	0.34	0.04	0.04	0.03	96.97
	100	1.27	0.38	0.04	0.04	0.03	96.15
	125	1.27	0.34	0.05	0.05	0.04	93.20
Ilorin	0	1.24	0.31	0.04	0.04	0.03	97.17
	50	1.24	0.31	0.04	0.04	0.03	97.17
	75	1.27	0.34	0.05	0.05	0.04	95.79
	100	1.32	0.34	0.04	0.04	0.03	97.58
	125	1.35	0.34	0.04	0.04	0.03	96.77
LSD		0	0	0	0	0	1.24

CP: Crude protein, CF: Crude fiber, C-fat: Crude fat, ash, MC: Moisture content.

Table 9. Effect of varieties and fertilizer rate on phytochemicals content

	PHYTOCHEMICALS COMPOSITION		
	Vit. A	Vit. C	Lycopene
variety			
Ogbomoso	0.97	18.68	7.99
Hausa	0.55	18.57	8.80
Ilorin	0.56	18.80	9.03
LSD	0.82	0.05	0.04
k rate (kg/ha)			
0	0.47	18.48	8.49
50	0.51	18.76	8.53
75	0.54	18.63	8.64
100	0.54	18.72	8.66
125	1.40	18.83	8.71
LSD (0.05)	1.06	0.07	0.05

Table 10. The interaction of varieties and fertilizer rate on phytochemicals content

	Phytochemicals		
variety	Vit A	vit C	lycopene

Ogbomoso	0	0.41	18.21	7.79
	50	0.47	18.60	7.91
	75	0.51	18.74	8.04
	100	0.47	18.89	8.02
	125	3.00	18.97	8.20
Hausa	0	0.47	18.27	8.73
	50	0.54	18.86	8.72
	75	0.56	19.04	8.83
	100	0.57	18.31	8.86
	125	0.60	18.36	8.88
Ilorin	0	0.52	18.97	8.95
	50	0.52	18.81	8.95
	75	0.56	18.10	9.07
	100	0.58	18.97	9.12
	125	0.62	19.17	9.06
LSD (0.05)		1.84	0.12	0.08

Vit A : Vitamin A , Vit C: vitamin C, lycopene.

Mineral Content

Effect of Varieties on Mineral Content

The influence of tomato varieties on mineral content is summarized in Table 11:**Calcium (Ca):** Ilorin variety had the highest value (6.00), while Ogbomoso variety recorded the lowest (5.29).**Iron (Fe):** Ilorin variety recorded the highest value (0.70), while Ogbomoso variety had the lowest (0.43).**Potassium (K):** Ilorin variety recorded the highest value (248.94), while UC82B variety had the lowest (240.53).**Magnesium (Mg):** Ilorin variety had the highest value (0.89), while Ogbomoso variety recorded the lowest (0.72).**Sodium (Na):** Hausa variety had the highest value (0.40), while Ogbomoso variety recorded the lowest (0.30).**Zinc (Zn):** Ilorin variety recorded the highest value (0.71), while Ogbomoso variety had the lowest (0.51).**Phosphorus (P):** UC82B variety recorded the highest value (6.39), while Ogbomoso variety had the lowest (5.59).The effects of varieties on mineral content were statistically significant.

Effect of Fertilizer Rate on Mineral Content

The impact of fertilizer rates on mineral content is shown in Table 11:**Calcium (Ca):** The 75 kg/ha MOP treatment had the highest value (5.96), while the control had the lowest (5.33).**Iron (Fe):** The 125 kg/ha MOP treatment recorded the highest value (0.64), while the control had the lowest (0.49).**Potassium (K):** The 125 kg/ha MOP treatment had the highest value (244.40), while the control recorded the lowest(232.06).**Magnesium (Mg):** The 125 kg/ha MOP treatment recorded the highest value (0.86), while the control had the lowest (0.77).**Sodium (Na):** The 125 kg/ha MOP treatment recorded the highest value (0.40), while the control had the lowest (0.32).**Zinc (Zn):** The 125 kg/ha MOP treatment recorded the highest value(0.69), while the control had the lowest (0.54).**Phosphorus (P):** The 125 kg/ha MOP treatment recorded the highest value (6.09), while the control had the lowest (5.34).Fertilizer rates significantly influenced all mineral content parameters.

Interactive Effect of Varieties and Fertilizer Rates on Mineral Content

The interactive effects are summarized in Table 12:**Calcium (Ca):** Ilorin variety with 100 and 125 kg/ha MOP recorded the highest values (6.06), while Ogbomoso, UC82B, and Ilorin varieties with control recorded the lowest (4.99, 5.05, and 5.95, U varieties with control had the lowest values (0.37, 0.49, and 0.62, respectively).**Potassium (K):** Ilorin variety with 125 kg/ha MOP recorded the highest value (252.87), while Ogbomoso, UC82B, and Ilorin varieties with control had the lowest values (216.07, 233.50, and 246.62, respectively).**Magnesium (Mg):** UC82B variety with 100 kg/ha MOP had the highest value (0.90), while Ogbomoso variety with control recorded the lowest (0.66).**Sodium (Na):** Hausa variety with 125 kg/ha MOP recorded the highest value (0.45), while Ogbomoso variety with control had the lowest (0.26).**Zinc (Zn):** Ilorin variety with 125 kg/ha MOP recorded the highest value (0.80), while Ogbomoso variety with control had the lowest (0.43). **Phosphorus (P):** Hausa variety with 125 kg/ha MOP recorded the highest value

(6.56), while Ogbomoso variety with control had the lowest (4.93).The interactive effect of varieties and fertilizer rates on mineral content was statistically significant.

Table 11. **Effect of varieties and fertilizer rate on mineral content**

	Proximate						
Variety	Ca	Fe	K	Mg	Na	Zn	P
Ogbomoso	5.29	0.43	224.88	0.72	0.30	0.50	5.59
Hausa	5.68	0.56	240.53	0.85	0.40	0.61	6.39
Ilorin	6.00	0.70	248.94	0.89	0.37	0.72	5.59
LSD	0.14	0	0.34	0	0	0.03	0.01
k rate (kg/ha)							
0	5.33	0.49	232.06	0.77	0.32	0.54	5.34
50	5.51	0.52	236.71	0.80	0.33	0.54	5.46
75	5.96	0.55	238.42	0.82	0.37	0.60	5.90
100	5.68	0.62	238.99	0.84	0.38	0.66	5.97
125	5.80	0.64	244.40	0.86	0.40	0.69	6.09
LSD	0.18	0	0.44	0	0	0.04	0.02

Ca: Calcium ,Fe: Iron ,K: potassium, Mg : Magnesium, Zn : Zinc, Na : Sodium, P: Phosphorus.

Table 12. The interaction of varieties and fertilizer rate on mineral content.

	Proximate							
Variety	(kg/ha)	Ca	Fe	K	Mg	Na	Zn	P
Ogbomoso	0	4.99	0.37	216.07	0.66	0.26	0.43	4.93
	50	5.07	0.38	224.07	0.65	0.27	0.43	5.03
	75	5.97	0.43	226.12	0.73	0.32	0.47	5.91
	100	5.04	0.45	225.65	0.76	0.33	0.53	6.02
	125	5.37	0.52	232.48	0.79	0.35	0.62	6.06
Hausa	0	5.05	0.49	233.50	0.83	0.35	0.55	6.06
	50	5.53	0.56	239.44	0.84	0.37	0.57	6.33
	75	5.90	0.56	240.38	0.85	0.41	0.62	6.47
	100	5.95	0.60	241.49	0.90	0.43	0.66	6.56
	125	5.98	0.62	247.85	0.82	0.45	0.66	6.56
Ilorin	0	5.95	0.62	246.62		0.35	0.64	5.04
	50	5.95	0.62	246.62	0.82	0.35	0.64	5.04

	75	6.01	0.68	248.77	0.90	0.37	0.72	5.33
	100	6.06	0.80	249.82	0.87	0.38	0.80	5.32
	125	6.06	0.80	252.87	0.87	0.41	0.80	5.64
LSD		0.31	0	0.77	0.98	0	0.06	0.03

Ca: Calcium ,Fe: Iron ,K: potassium, Mg : Magnesium, Zn : Zinc, Na : Sodium, P: Phosphorus.

Discussion

This study looked at how the development, fruit production, and nutritional value of three tomato varieties—Ogbomoso Local, UC82B, and Ilorin—were affected by the rates of potassium (K) fertilizer. The application of potassium fertilizer was found to have a positive effect on tomato plant growth and yield. This outcome verifies the findings of Chapagain and Wiesman (2004), who discovered that adding potassium boosts fruit output and plant growth. Potassium is required for a range of physiological tasks, including photosynthesis, controlling stomatal openings, and transporting nutrients and water throughout the plant (Havlin et al., 2005).

Potassium is recognized to support the general health and growth of plants since it influences numerous cellular activities. One of potassium's main roles is to regulate the opening and closing of stomata. The stomata, which are microscopic pores on plant leaves that allow gas exchange, are maintained in part by potassium. This is crucial for optimizing photosynthesis since it regulates the amount of carbon dioxide that enters the plant and the amount of water vapor that exits it (Havlin et al., 2005). Additionally, potassium facilitates the synthesis of ATP (adenosine triphosphate) in plant cells. Numerous plant functions, including food translocation, cellular respiration, and the activation of growth-related enzymes, depend on ATP, a vital energy carrier (Hepler et al., 2001). K's function in regulating energy and nutrient flow also helps tomato plants develop and produce more fruit.

Potassium's effects on cell growth mechanisms are also responsible for its growth-promoting effects; it stimulates ATPase enzymes in cell plasma membranes, which creates an acidic environment inside the cell, which helps to loosen the cell wall and allow for cell elongation and expansion (Oosterhuis et al., 2014). This mechanism is especially significant in the early stages of plant growth, when cell division and elongation are essential for building a robust plant structure.

Moreover, another factor contributing to potassium's beneficial effects on growth is its mobility throughout plant tissues. It helps to keep the equilibrium between cations (positively charged ions) and anions (negatively charged ions) in the cytoplasm of plant cells by controlling osmotic pressure. In this way, potassium aids in controlling water intake, which helps the plant flourish in a variety of environmental circumstances (Kaiser, 1982).

Potassium has been shown to improve fruit quality by influencing the synthesis of soluble sugars, organic acids, and soluble solids, which are important indicators of fruit taste, texture, and shelf life. Research has shown that plants grown with adequate potassium levels have higher concentrations of soluble sugars, which contribute to better fruit flavor and sweetness (Havlin et al., 2005). Potassium also aids in the synthesis of organic acids, which contribute to the flavor profile of the fruit and help preserve its shelf life after harvest. Moreover, the application of potassium fertilizer has been shown to significantly increase fruit yield, especially marketable yield, as evidenced by the higher fruit production in plants treated with potassium.

The observed improvements in fruit length, diameter, and weight further support the significant role of potassium in improving tomato yield and quality, which is consistent with the findings of other studies that indicate potassium application increases fruit size and quality, resulting in a higher market value for the produce.

Potassium application was found to improve the nutritional quality of tomato fruits by improving their moisture content (MC), crude protein (CP), crude fiber (CF), and carbohydrates (CHO). This is in line with research that suggests potassium improves the nutrient profile of crops by improving the transport of essential nutrients to different parts of the plant and optimizing plant metabolism.

According to the current study, the Hausa variety had the highest crude protein and fiber content, while the Ilorin type had the highest value for moisture and carbohydrates. The increased nutritional profile in all tomato types shows the impact of potassium fertilizer, while genetic variations in nutrient uptake and metabolism may be the cause of this variation in nutritional content. These results demonstrate how potassium may play a significant role in raising the total nutritional content of tomato crops, especially for consumers looking for product that is high in nutrients.

Ogbomoso Local, Hausa, and Ilorin were the three tomato varieties used in this study. The Ogbomoso Local variety consistently produced more fruit and had better nutrient content than the Hausa and Ilorin varieties, especially when fertilized with potassium at optimal rates. This suggests that some tomato varieties may react more favorably to potassium application, probably because of their innate genetic traits and their capacity to absorb and use potassium effectively.

Variety has a major impact on growth and nutritional content, which highlights the importance of taking varietal differences into account when advising farmers on fertilization techniques. To maximize output and quality, producers could, for example, select particular tomato varieties that are more appropriate for their soil type and nutrient management techniques.

Conclusion and Recommendation

Recommendations

Based on the study's findings, the following suggestions can be made to maximize tomato production using variety selection and potassium fertilizer:

1. **Optimal Fertilizer Rate**: The study's findings demonstrate that potassium fertilizer, specifically MOP (Muriate of Potash), applied at a rate of 75 kg/ha, considerably enhances tomato growth and yield metrics, including plant height, leaf and flower counts, fruit size (diameter and length), and fruit weight. In order to increase fruit yield and get the ideal growth parameter, growers are advised to use MOP at a rate of 75 kg/ha. The cost-effectiveness and long-term impacts of this application rate, however, could be investigated in more detail.
2. **Varietal Selection**: When 75 kg of fertilizer per hectare was applied, the Ilorin variety produced the most fruit. When paired with the right potassium application, this variety exhibits a tremendous potential for high yield. Consequently, growers who want to increase fruit yield can think about cultivating the Ilorin variety, particularly in areas where potassium is the limiting nutrient. To find varieties that can use potassium fertilizers to their full potential, varietal trials in various soil types should also be carried out.
3. **Balancing Fertilizer and Nutrient Content**: Future research should concentrate on identifying a balanced fertilizer regimen that improves both yield and nutritional content, ensuring that farmers can produce both high-yield and nutrient-dense tomatoes. Although potassium fertilizer applied at 75 kg/ha improved growth and yield parameters, it also resulted in lower nutritional content when compared to other fertilizer rates, suggesting that although potassium is necessary for growth, its excessive application may not be ideal for optimizing the nutritional profile of tomatoes.
4. **Soil Testing and Fertilizer Management**: In order to prevent overfertilization and enhance nutrient management practices, farmers should regularly test their soil to measure the potassium levels before applying fertilizers. Integrated nutrient management (INM) strategies that combine organic and inorganic fertilizers should also be taken into consideration for sustainable tomato production.

Conclusion

In conclusion, tomato plant growth and yield were greatly impacted by the application of potassium fertilizer, specifically MOP at 75 K2O ha. The administration of potassium fertilizer improved fruit attributes including fruit weight, diameter, and length as well as important growth metrics like plant height, leaf count, and flower production. Additionally, the study discovered that the Ilorin local variety yielded the most fruits when treated with 75 kg/ha of MOP, suggesting that it has the potential to produce a large amount. The results of this study highlight how crucial potassium is to tomato production and how it enhances plant development, fruit production, and nutritional value. The trade-off between increased yields and nutritional quality, however, indicates that careful fertilizer rate management is required to attain the best possible balance between tomato crop quantity and quality. More research should concentrate on improving fertilizer techniques and examining the relationship between soil types, tomato varieties, and varying potassium fertilizer ratios, as the agricultural sector faces increasing demands for both high-yield and high-quality crops. This will support farmers in adopting sustainable methods and making well-informed decisions, which will raise tomato productivity and nutritional quality.

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